# Design Engineering

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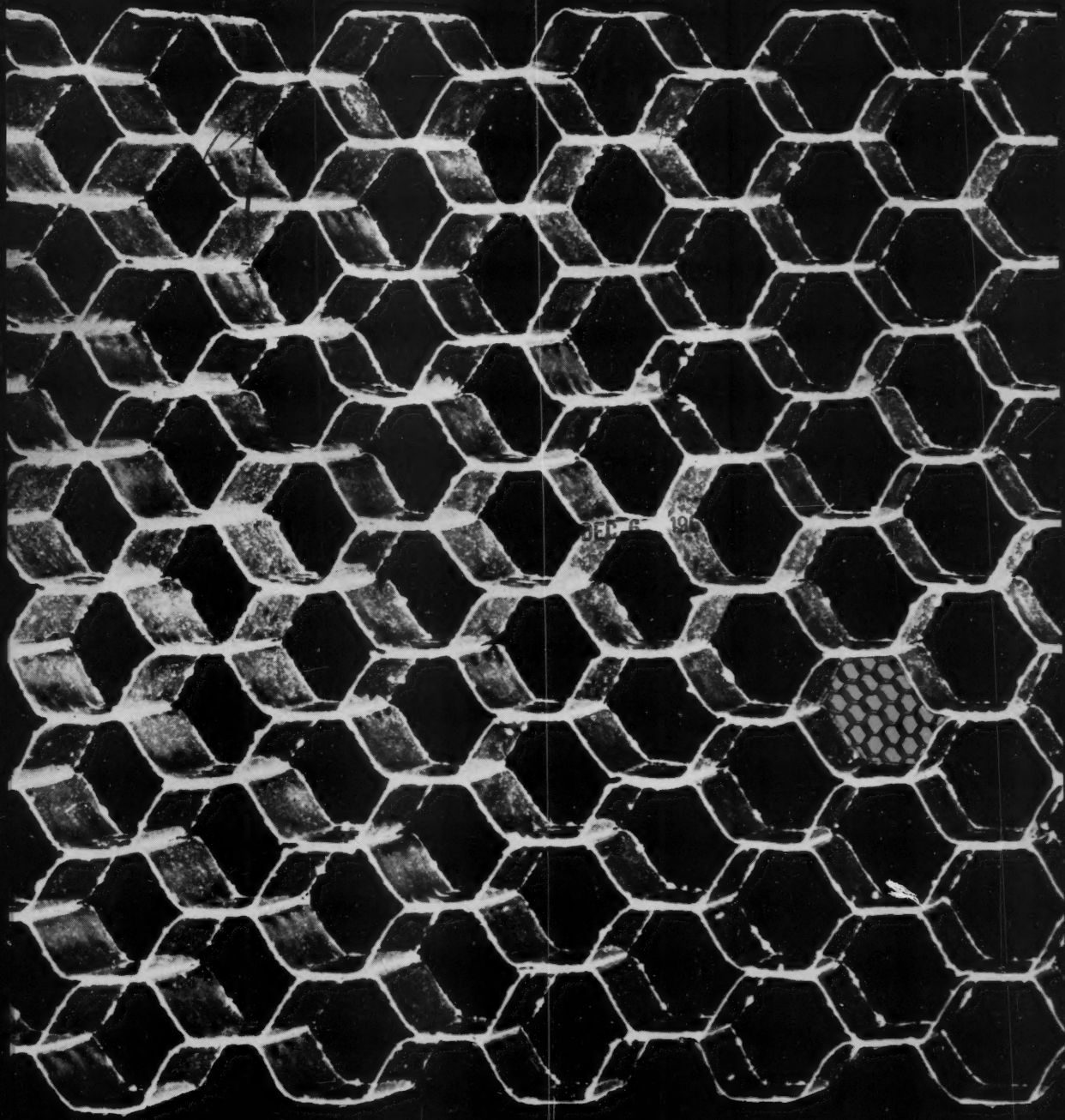

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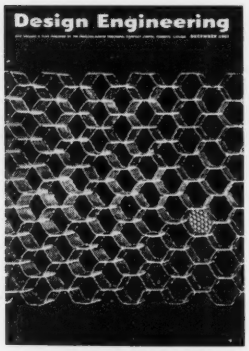


## This month's cover

Miniaturization means different things to different people. For some it has solved problems—like devising components small enough to function in space - ship mechanisms. For the fabricating companies—it has usually meant nightmares. Take for instance the stainless steel honeycomb shown on our cover: how would you go about making it? The little colored section is actual size. Canadian Vac-Hyd solved the problem by vacuum brazing. For more on the story turn to page 27. Cover picture is by Ron Vickers, ARPS.

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Design Engineering

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## Letters to the Editor

# Design protection article stirs them up

**Dear Sir:**
Mr. Johnson's article in the November issue on Product Design Protection or, more correctly, the lack of protection, is not only timely but a subject which badly needs airing. Even more, it needs attention and immediately. However while I agree that he has taken a big step forward with his suggestions for a new Act to provide design protection, I think that any legislation which does not protect the designer . . . first, instead of through the manufacturer is weak and offers too many loopholes for hanky-panky.

The designer should be protected, just like an inventor who, when he sells his invention exclusively to one manufacturer, assigns the patent to him. It is conceivable too that more than one manufacturer might be interested in producing the product on a non-exclusive basis. When the designer owns the protection he can then license producers to manufacture under a royalty agreement.

Perhaps what we need in Canada is a regulation similar to that in the U.S. which affords protection in the form of a Design Patent. In the meantime it appears to me that we still have some protection under existing legislation. The Copyright Act is one means even though Mr. Johnson seems to think differently. If however drawings and a description of the product are copyrighted, it would appear that any copying of the design would obvioulsy involve an infringement of the copyright because it would be necessary to copy the drawings.

However, one can always revert to that old tried and substantially true idea of mailing a detailed and illustrated description of the idea to oneself by registered mail. Then keep the envelope intact in some safe place. This establishes proof of priority of conception. Any competitor who brings out copies of the product at any time subsequent to the registration date is plagiarizing the idea. Dates stamped on the article itself are subject to finagling; the date may even be faked by unscrupulous manufacturers.

Mr. Johnson however is on the right track and I think the ACID, the PAC and other interested groups should get behind him and vigorously lobby for some effective legislation to protect the designer from exploitation and the design from cheap copying.

**President**
**Leonard Arthur Wheeler,**
**& Associates Inc.**

Toronto, Ont.

**Dear Sir:**
Mr. J. R. Johnson's excellent article (Nov., 1961) on the need for adequate industrial design protection draws attention to a matter that is becoming increasingly important if Canada really wishes to develop a strong and vital secondary industry.

The plea by Trade Minister George Hees for Canada to stop imitating designs, quoted in your column "Overheard in Ottawa", gives the hope that at last there is a sympathizer in the cabinet and that this is the ideal time for action.

Having opened this subject in your pages, I hope that you will not close it again until satisfactory legislation has been obtained.

The Royal Commission states in its report that it "seriously considered recommending the repeal of our present Act with the substitution of nothing in its place", and the opinion that Canada does not need design protection still has its proponents.

I hope you will have space for a few comments in support of Mr. Johnson and against this opinion. As with industrial designers, the opinions of patent agents are suspect as being self-serving, but I hope that the fact I am a "tame" company agent, and so have no financial interest in this matter, will mean that my comments are more acceptable than those from my "wilder" colleagues in private practice.

**We must compete**

Canada's present high standard of living inevitably makes it harder for the exporter to maintain a price advantage over competition. The "pirating" of old and well established designs does not usually help, since they are available to all and their adoption gives no particular competitive edge. The "pirate" manufacturer will therefore prefer to use the most advanced and ingenious designs he can find, and these are the very designs for which strong protection is most easily obtainable abroad.

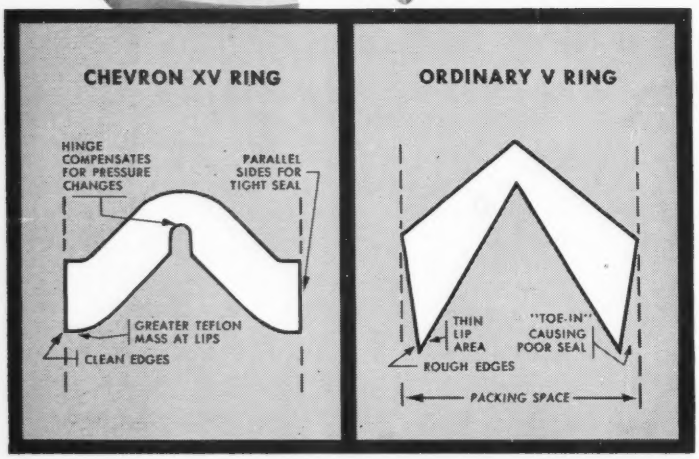
The pirate is safe as long as he is supplying only the Canadian market, but if he attempts to export he will often be stopped, or will lose his profit in license fees, in the countries in which the design is protected. The foreign designer is careful to obtain his protection in the best markets, and the pirate is then left to scrabble in the rest. The indications to me are that the situation of the exporting pirate will become much worse in the future.

*Continued on page 61*

# NEW

## GARLOCK CHEVRON* XV TEFLON† PACKING

for Hydraulic, Pneumatic Service




**A new high in V-ring performance** and efficiency is here from Garlock in the new CHEVRON XV Teflon Packings. Used for valves, pumps and instruments in corrosive service, this exclusive Garlock design has outperformed ordinary Teflon V-rings in rigid controlled tests. CHEVRON XV is superior in flexibility, freedom from friction, wear resistance and sealing efficiency under varying pressures—withstands pressures to 1000 p.s.i. (rings without hinges available for pressures above 1000 p.s.i.).

**Can be molded precisely.** The greater material mass of CHEVRON XV permits molding to consistent close tolerances ring after ring—batch after batch. Result—perfect fit, clean lips, far better sealing.

**Ends frequent gland adjustment.** The exclusive CHEVRON hinge compensates for pressure changes automatically. With proper installation, further adjustments are eliminated.

**Greatly extends wear.** Greater material mass and parallel sides give Garlock CHEVRON XV PACKINGS much more working Teflon than ordinary V-rings. Sturdier size for size, they wear considerably longer . . . yet cost you no more.

**Virtually ends friction** because of two factors. First, Teflon has the lowest coefficient of breakaway and running friction of any solid material in use today. Second, the exclusive CHEVRON hinge action permits free operation with minimum friction at all pressures.

**Learn the full story** of this superior new packing. Discuss your particular needs with your Garlock representative. Call him at the nearest of 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-192, Garlock of Canada Ltd.

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# Reports — A world roundup of engineering and design interest

## New source of electrical power for space communications

A highly efficient cell for supplying electrical power in high temperature and radiation environments has been developed using hydrogen and oxygen for fuel. It comprises an inorganic ion-exchanging membrane which operates at higher temperatures than organic types now in use.

Hydrogen causes a reaction on one side of the membrane which gives off electrons. Oxygen on the second side creates a void in electrons. When hydrogen ions travelling through the membrane complete the circuit, electrons flow from the anode (surplus electrons) to the cathode.

Experimental cells, about the size of a quarter, have produced .95 volts over an open circuit. The inorganic membrane is capable of attaining up to 100 amperes per sq ft. Organic cells attain only about 35 amperes. With any number of the wafer-type cells arranged in series, sufficient voltages may be derived to supply the power for satellite communications, telemetry devices in space and military portable equipment. *Source: Illinois Institute of Technology.*

## New tellurium steel machines 3½ times faster

A U. S. company has developed a new steel which machines 3½ times faster than standard screw machine steel. In a series of tests machining speeds of 600 sfm (surface feet per minute) were recorded. Secret is tellurium, a member of the sulphur-selenium family and an element already used in thermo-electric devices and semi-conductors.

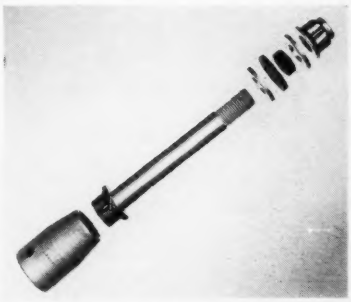
For the tests, a new six spindle automatic screw machine was used to make spark plug shells from 13/16 in. hexagon bar stock of tellurium steel from several heats. However there were no great differences between heats. After trial runs of turning, shaving, reaming, drilling and knurling, basic tests were started at 528 sfm. Step by step the speed was increased to 618 sfm. In all the tests there was no appreciable wear in tool or drills. *Source: La Salle Steel Co.*

## Students design geodesic dome for lumber industry

The senior design class at a U. S. university is designing and constructing a "basketry dome", 72 ft in diameter and covering 4,000 sq ft. It will be made of conventional douglas fir 2x4's interwoven into a basket-like experimental structure.

Calculations and actual manufacturing and construction will be done by nine undergraduates as part of a project set by R. Buckminster Fuller, a noted designer, architect and mathematician who is the university's research professor in design. His aim is production of a shelter system which might be important to the lumber industry or even the home owner. *Source: Southern Illinois University.*

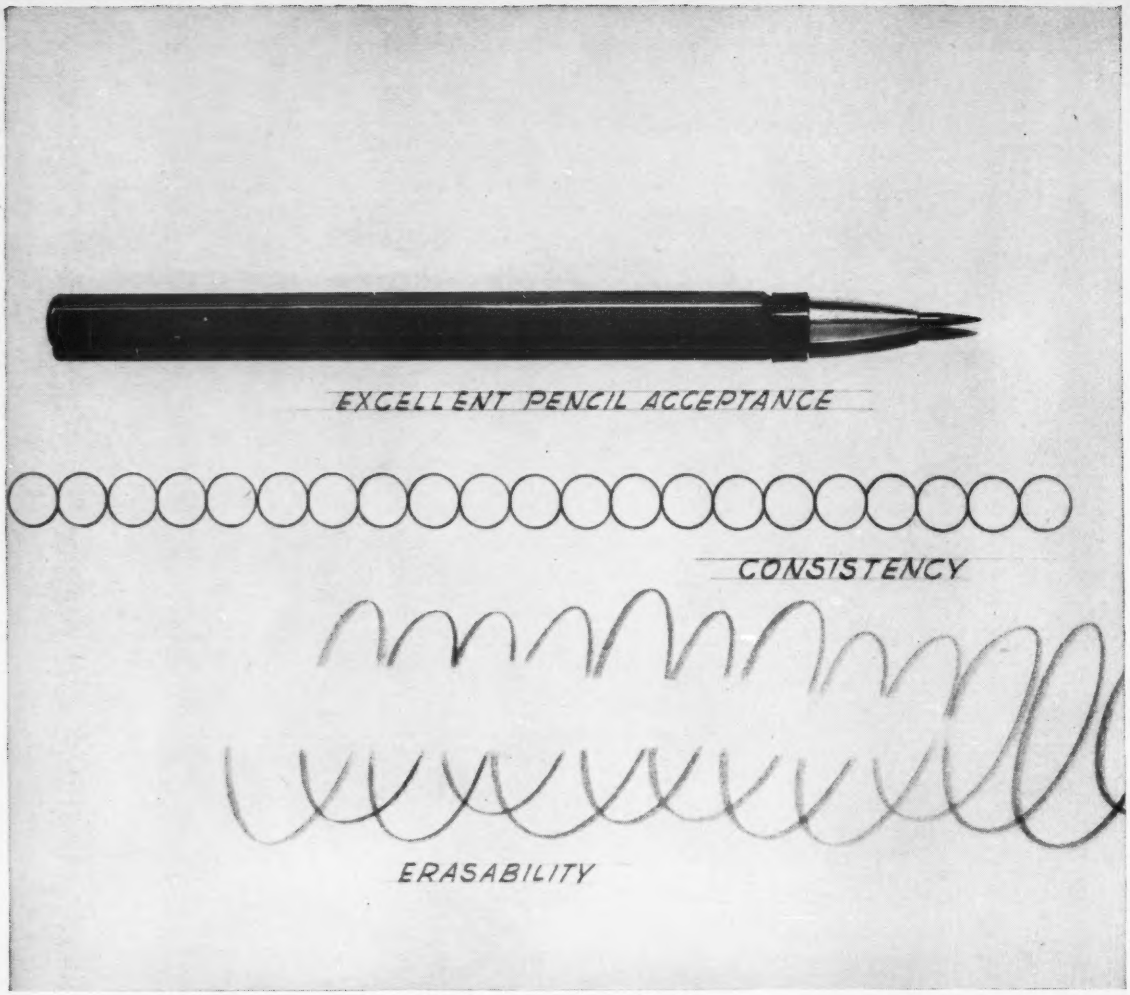
## Steel fastener rated at 300,000 psi tensile strength



A tension and shear bolt just produced is claimed to be the first standard structural component rated at 300,000 psi tensile strength. It has resulted from a call by the U. S. Defence Department for new fasteners which would help achieve a 10 to 20 percent reduction in the weight of aircraft landing gear assemblies to "make possible a propeller driven aircraft speed above Mach 2." Although applications are classified the new product will most likely be used on advanced prototypes of the Mach 3 B-70 bomber and missile booster rockets and engines.

The 300,000 psi development is actually a fastening system rather than just a bolt. Mating locknuts, load-bearing and preload indicating washers, and high strength socket wrench were developed simultaneously.

One of the most interesting observations is an indication that strength of steel bolting, and other steel components, can be pushed nearer the metal's theoretical limit of approximately 2,000,000 psi. It elevates steel to a point comparable with titanium in the strength-to-weight spectrum. Comparing strength to density, highest strength titanium fasteners to date have a 1,000,000 ratio, while the new steel fastener is rated at 1,100,000. *Source: Standard Pressed Steel Co.*

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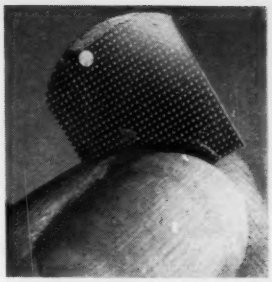
## New process seals microminiature devices with thin glass film



Transistors and diodes can now be reliably sealed with a film of glass, one ten-thousandth of an inch thick using a new high-volume, cost-reducing process. Conventional sealing methods, such as separate chip encapsulation or metal containers, are eliminated.

The new process begins with conventional fabrication of diodes or transistors on silicon wafers, followed by oxide coating. At this point a special glass powder is applied to the oxidized surface and the entire wafer fired at more than 1500F. The result is a microscopically thin film of chemically resistant glass with a smooth, pinhole-free surface. By cutting the wafer with an ultrasonic "knife", each diode or transistor retains its own permanent glass seal. Electrical contact is made through small holes etched through the glass and oxide. *Source: International Business Machines Corp.*

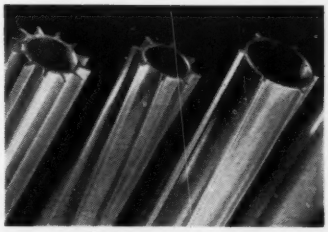
## Soon: a reactor that directly converts its energy into electricity

A nuclear engineer has forecast 1966 as the operation date of an atomic reactor which uses thermionic units right in its fuel elements for converting heat directly into electricity. The system would be a must for modern space laboratories and could be the answer for new propulsion systems, including the ion engine.

The engineer told the International Symposium on Aerospace Nuclear Propulsion, in Las Vegas, that advanced design had been completed on direct conversion systems in the 60 and 300 kilowatt power ranges, with a 2000 kw unit under conceptual development. The 300 kw Direct Conversion Reactor would use about 250 thermionic fuel rods each producing about 1 kw, and all contained in a core 22 in. high and 11.75 in. in diameter. Liquid lithium would be circulated through the reactor core as coolant by an electromagnetic pump. Thermionic converters inside each rod would change the high core heat into electrical energy.

At present experiments are under way to develop an effective seal between metal and ceramic components which would withstand corrosion and operating temperatures of about 1400 F. *Source: Martin Company.*

## Sintered aluminum tubing now produced in Canada



The first products made from sintered aluminum powder (S.A.P.) are now being produced in Canada for nuclear power applications where low neutron absorption is required.

S.A.P. is manufactured from extremely fine, pure aluminum powder with an oxide content as high as 15%. Having the same strength at room temperature as heat-treated aluminum alloys, it does not lose its strength when heated for long period at room temperatures up to 500 C. For example, at 400 C it shows five times the strength of aluminum alloys. It also has the corrosion resistance of pure aluminum, higher thermal and electrical conductivity, and lower thermal expansion than aluminum alloys.

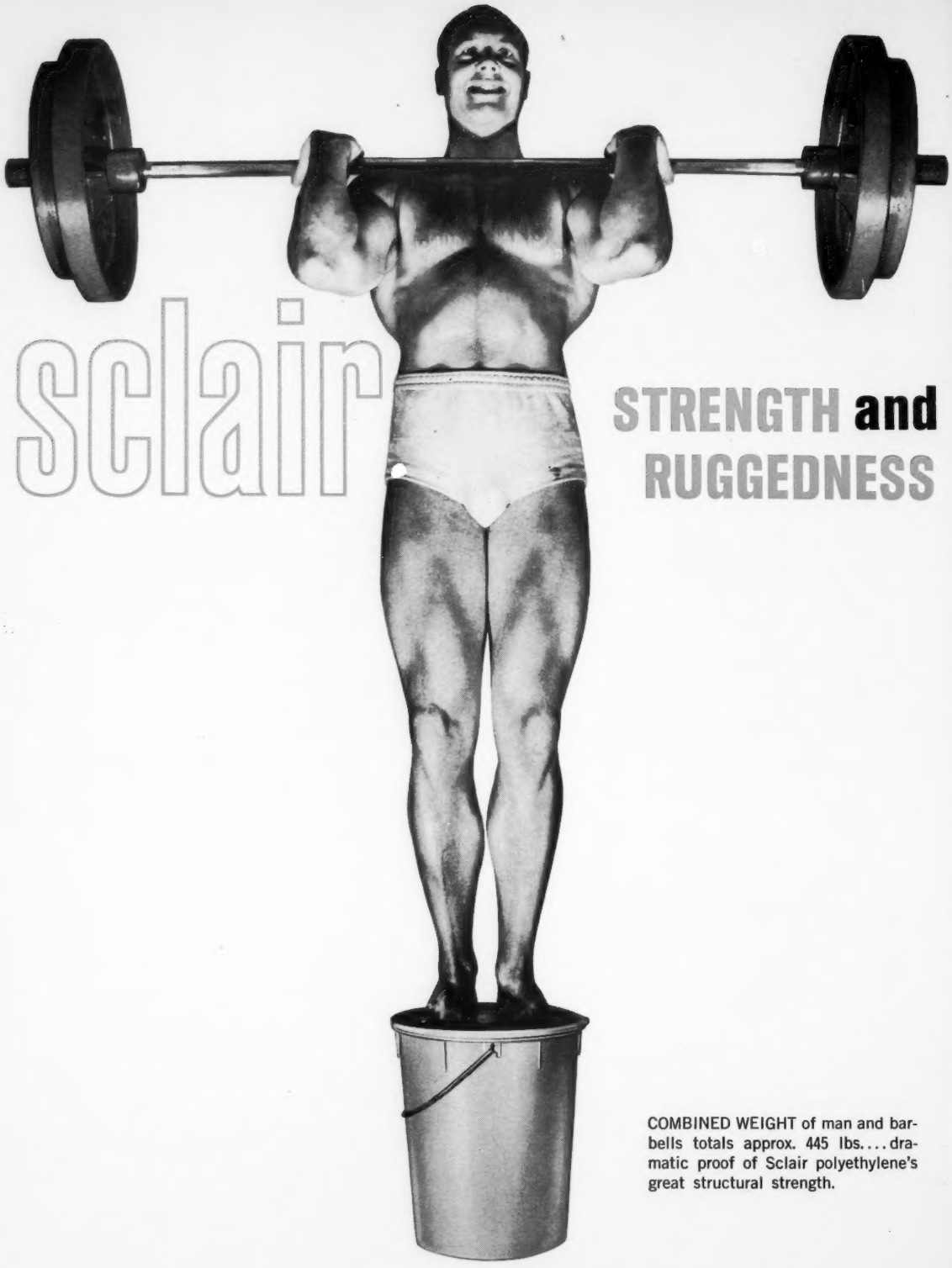
Production so far has been confined to round and finned tubes, the latter having spiral fins extruded integrally with the tube. *Source: Aluminum Company of Canada, Ltd.*

## Device to simplify circuitry in precision receivers

Successful combination of piezoelectric and piezomagnetic transducers has produced a low frequency gyrator which violates the reciprocity principle. A recent technical paper divulged that the device transforms voltage into current, an inductor into a capacitor and a short circuit into an open circuit. One possible use is for elimination of cross-talk in telecommunications.

The antireciprocal network behavior is characterized by transfer parameters which are equal in magnitude but opposite in sign (a 180 degree phase displacement) for the two directions of signal transmission. Similarly, any network combination consisting of a reciprocal system cascaded into a gyrator exhibits reciprocal behavior. Networks in series or parallel with an antireciprocal system result in a nonreciprocal combination. In this case transmission characteristics in the two directions differ in magnitude as well as phase. By proper choice of the auxiliary networks it is thus possible to produce an isolater, i.e. transmission in only one direction.

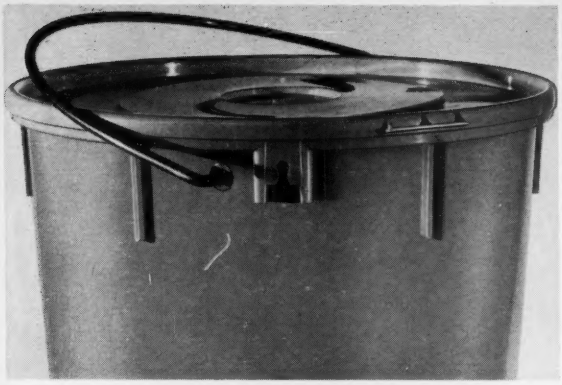
The experimental device combined lead titanate zirconate piezoelectric ceramic and nickel cobalt magnetostrictive ferrite (with permanent magnet biasing) transducers bonded together with unity mechanical coupling to form a single resonant structure. *Source: Clevite Electronic Research Center.*



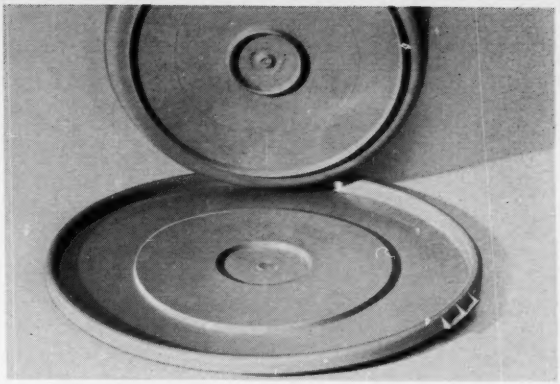
# sclair

## STRENGTH and RUGGEDNESS

COMBINED WEIGHT of man and barbells totals approx. 445 lbs.... dramatic proof of Sclair polyethylene's great structural strength.



Moulded fins act as stops so the bucket cannot slide too far down and stick to the bucket in which it is stacked. The keyhole slot permits the handle to be snapped in or out.



A wide reinforcing ring on the lid fits in between the two rims in the bottom of the bucket. This permits positive, non-skid stacking when the bucket is used as a warehouse container.

# solve a pailful of problems for the Food Industry!

Contamination is the bugbear of the food industry. And **metal** bulk transfer buckets suffer dents which often cause contamination. So Produits Diamant Ltée., of Ville Ste-Marie, Quebec, called on Les Industries Provinciales – designers and injection moulders of the highly successful new polyethylene sap buckets. Perhaps SCLAIR* polyethylene would solve **this** long-time problem, too?

Here were the critical service requirements:

- STRONG enough to support high stacking when full;
- RUGGED enough to withstand rough handling in plant, storage or transportation;
- TOUGH enough to resist both near-boiling and below zero temperatures, as well as detergent and sterilization washes.

Les Industries Provinciales turned to SCLAIR once more; and it tested out against every single specification with a good margin to spare. SCLAIR polyethylene's great mouldability also permitted many exclusive design features. See photo captions.

Investigate the application possibilities of SCLAIR polyethylene for your business. Remember that it offers remarkable impact resistance, too... It can be moulded in a variety of colours... And it is free from odour.

SCLAIR polyethylene resins – now being produced at Du Pont's St. Clair River Works – are Canadian-made and competitively priced. Write or call for complete information and technical service.

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PLASTICS DIVISION
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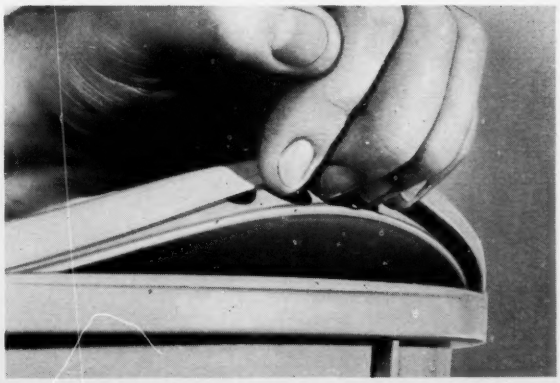
***Sclair** is Du Pont of Canada's trademark for its polyolefin resin.

These pails are so strong they are being stacked nine high in three pallets. They are not brittle even at temperatures well below zero.

The inner lip on the lid snaps into a groove on the inside of the rim to give a positive air-tight seal. Yet the lid releases easily enough with properly applied pressure in the centre.



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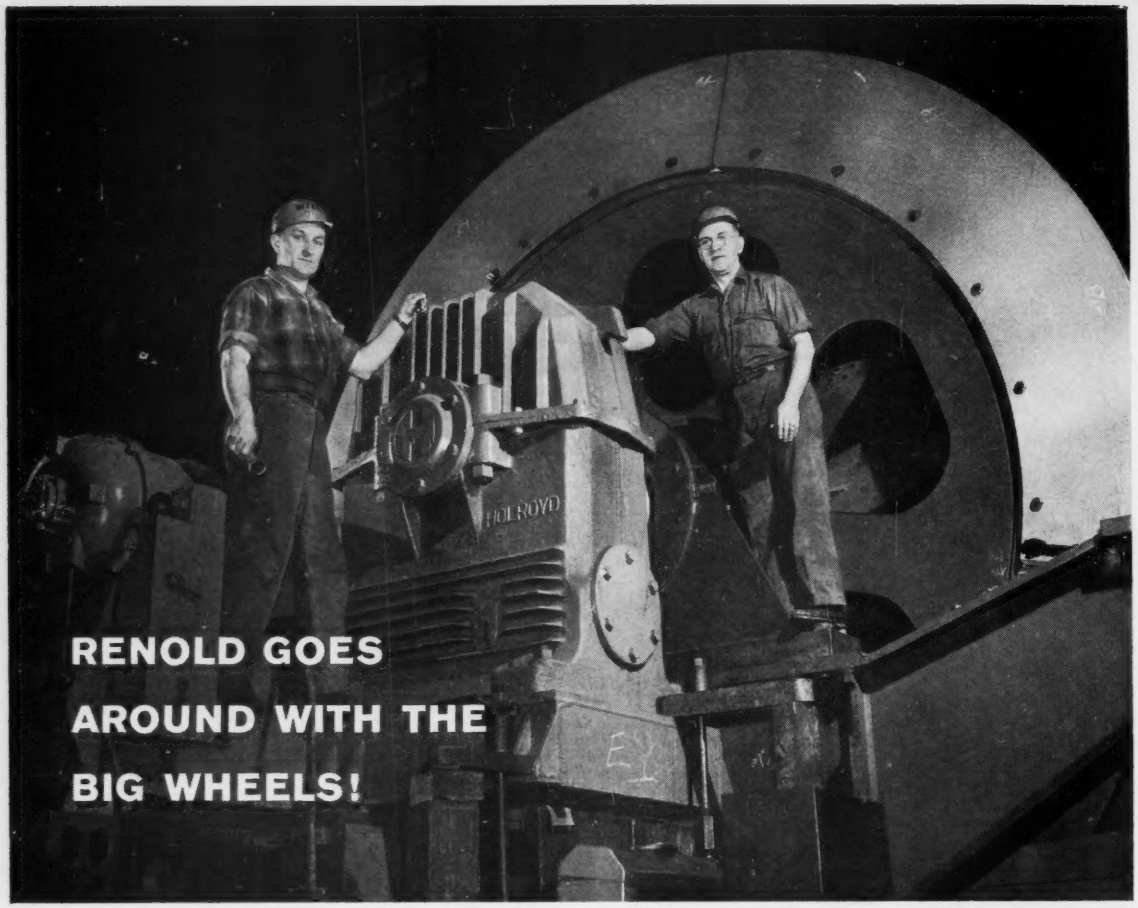


Like most "big wheels", this Westinghouse mine hoist brake disc moves in very limited circles. Machining this and other large drums requires controlled rotation speeds.

The Renold-supplied Holroyd Speed Reducer, shown in the foreground, provides the required turning speed. Powered by a Westinghouse motor, this precision-made gear unit provides the reliable performance essential in this specialized manufacturing process.

Westinghouse take advantage of its' versatile nature since it is used throughout their Hamilton plant on operations such as coil installation and rotor banding in the manufacture of large and medium sized electric generators and motors.

Throughout Canadian Industry, specialized power transmission problems can be solved *most efficiently* and *more economically* with experienced, qualified help. For assistance with *your* installations, call Renold—first name in power transmission!

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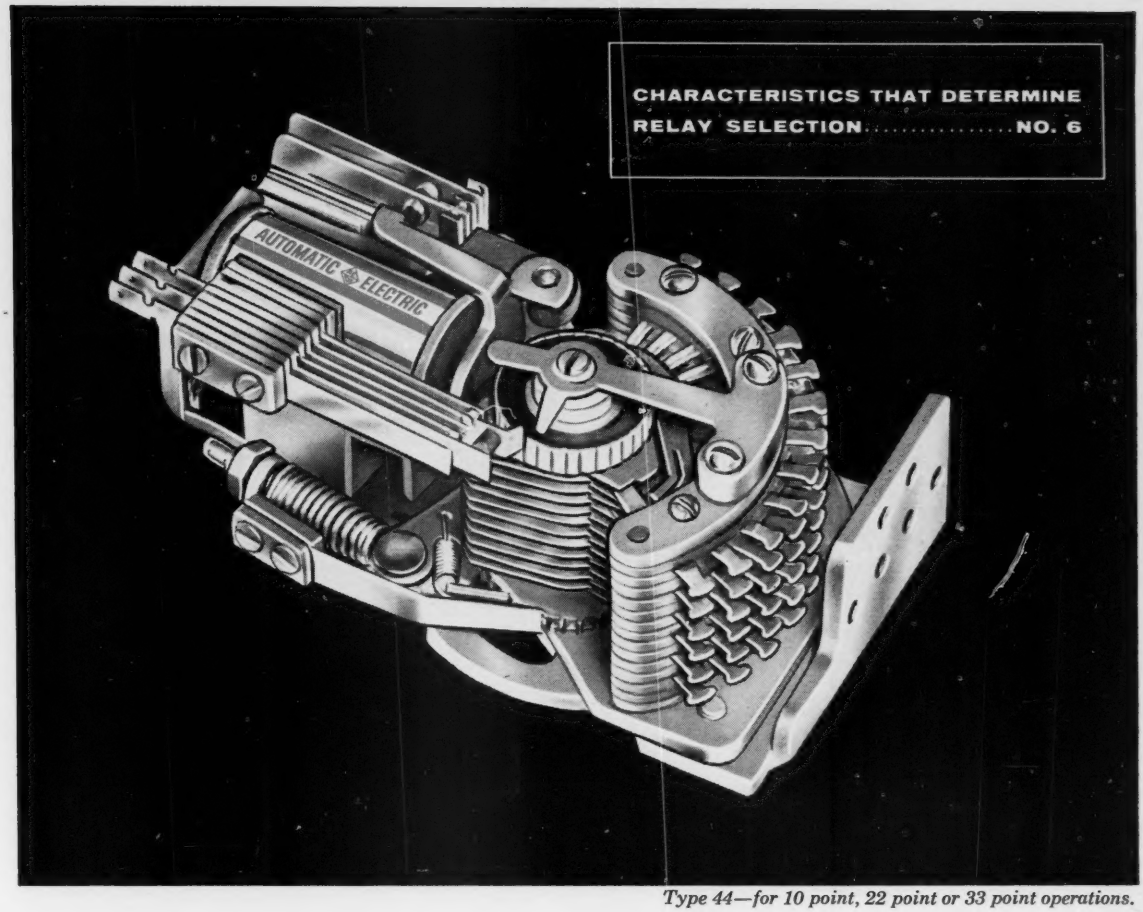


*Type 44—for 10 point, 22 point or 33 point operations.*

# solving complex space and weight problems

**Helpful selection data**
**Type 44 rotary stepping switch**

**CAPACITY**
Up to six 10-point bank levels
10, 22 or 33 point operation

**OPERATING VOLTAGE**
Any d-c voltage to 110, or 115 volts, 60 cycles a-c with rectifier

**OPERATING SPEED**
65 steps per second self-cycling

**OPERATING LIFE**
200 million steps or more, self-interrupted

The Type 44 rotary stepping switch by Automatic Electric, is not much bigger than a pack of cigarettes, yet it can accommodate up to six 10-point bank levels. It can be used for almost any d.c. switching operation . . . for fast and reliable impulse-controlled response . . . or for completely trouble-free self-interrupted operation. And because it is extremely light for its capacity, it simplifies not only equipment design, but space and weight problems—over a wide range of applications—as well. The ten bank levels have corresponding wiper levels, and by proper arrangement of the wipers the switch can be used for 10 point, 22 point, or 33 point operation. Cost is reduced by the one-coil design which eliminates a separate release coil, and the switch has an average life of 200 million steps—or more.

The rugged Type 44 has been tested and proven on a tremendous range of applications. If you would like further information, call or write Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto, Ontario. Branches across Canada.

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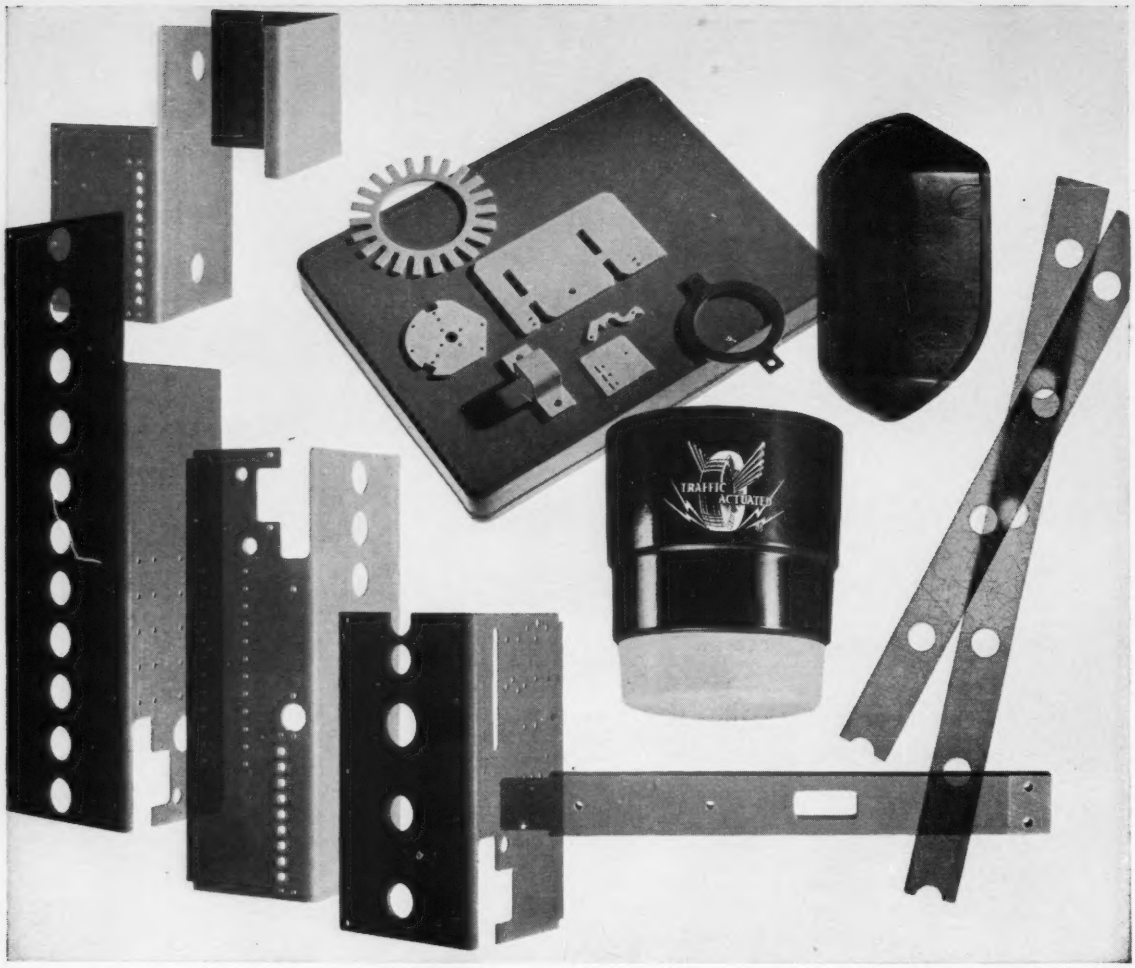


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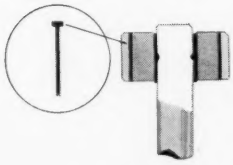
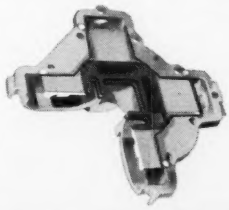
Adhesive bonding of thin metal aircraft skins, metal braces, stiffeners and other parts was pioneered by the aircraft industry to develop stronger yet lighter, faster, higher flying planes. Certainly, if "Scotch-weld" Structural Adhesives are used to advantage in assembling multi-million dollar high-speed aircraft, they can also be used to advantage in load-bearing applications in many other industries. This modern, high strength method of joining metals, reinforced plastics and other materials, permits improved design and production techniques, cuts costs and offers many unique benefits . . . smoother contours . . . lighter gauge materials . . . reduced inspection . . . unusual combinations of materials, and so forth. Already, "Scotch-weld" Structural Adhesives have solved design and production problems for manufacturers of appliances, metal shipping containers, pneumatic tools, pumps, motors, scaffolding and many other items. They may be able to do the same for you. Mail the coupon and let us show you how.



Adhesive bonding small pinion gears to rotor shafts provided savings of $56.37 per thousand by reducing rejects, and eliminating secondary operations and the necessity for 100% inspection.

A pump manufacturer reduced rejection rates from a high of 25% to nearly zero by adhesive bonding three separate die castings to form a single part.



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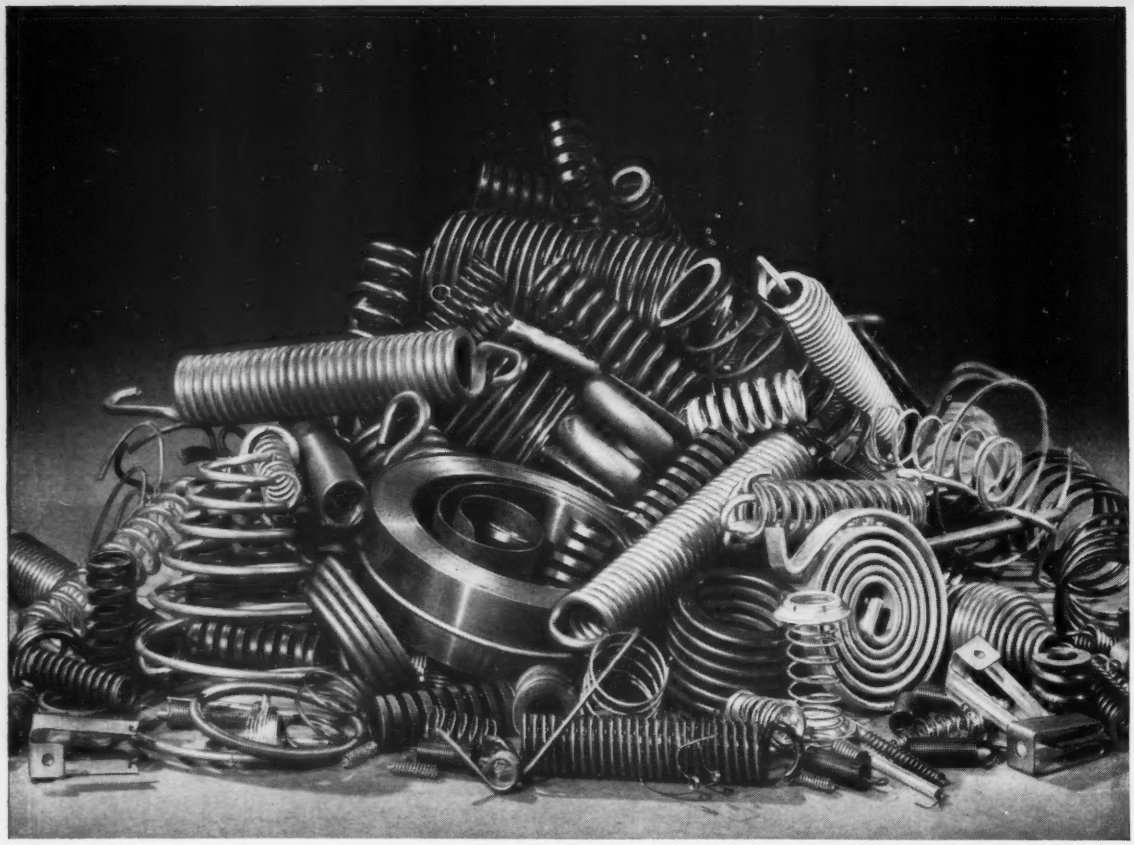

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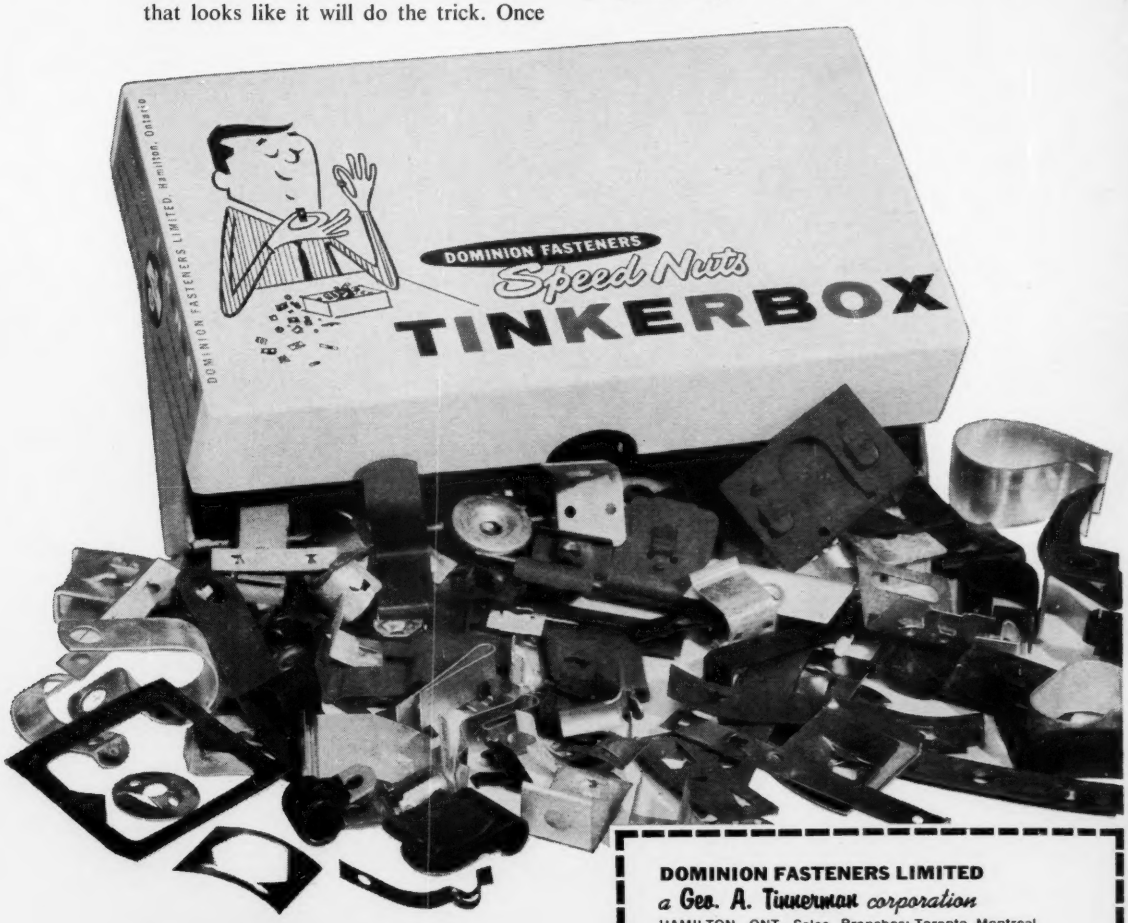


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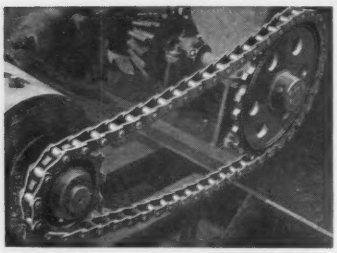

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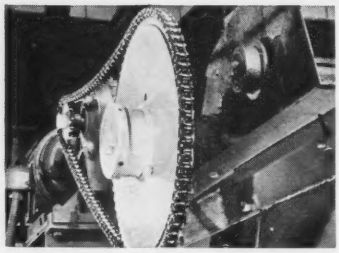
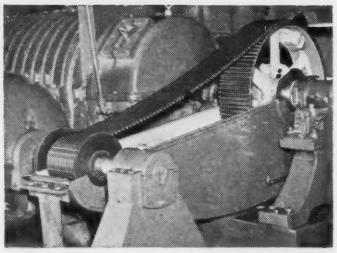
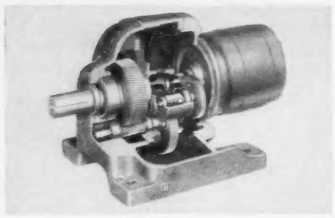


**ROLLER CHAIN DRIVES**—In single or multiple strands in ¼″ to 3″ pitch and 1″ to 3″ double pitch, including sprockets—over 2000 types and sizes.



**SILENT CHAIN DRIVES**—For fractional up to thousands of horsepowers, 3/16″ to 2″ pitch in ratios up to 12:1. Compact, quiet, positive.



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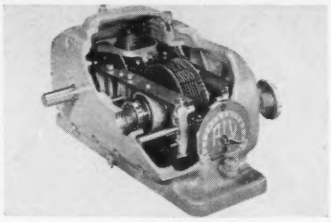

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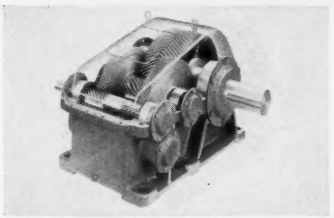

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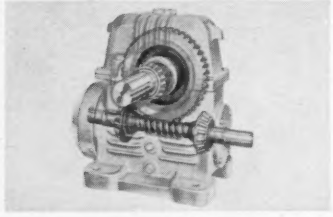

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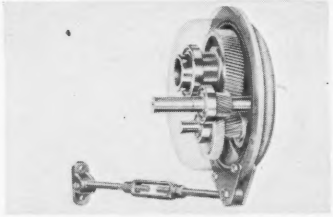

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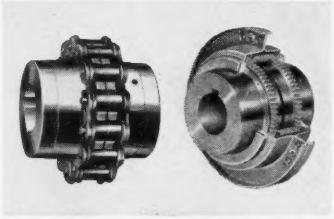

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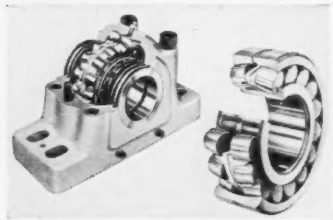
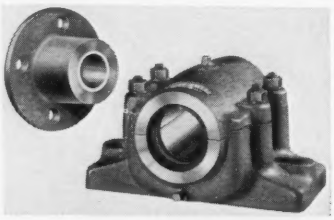


**SELF-ALIGNING BALL AND SPHERICAL ROLLER BEARINGS**—Pillow blocks, flanged, flanged-cartridge, cartridge and takeup blocks for shafts up to 11″.



**BABBITTED AND BRONZE BEARINGS**—Pillow blocks and flanged blocks in 17 rigid and self-aligning types, shaft sizes from ½″ to 12″.

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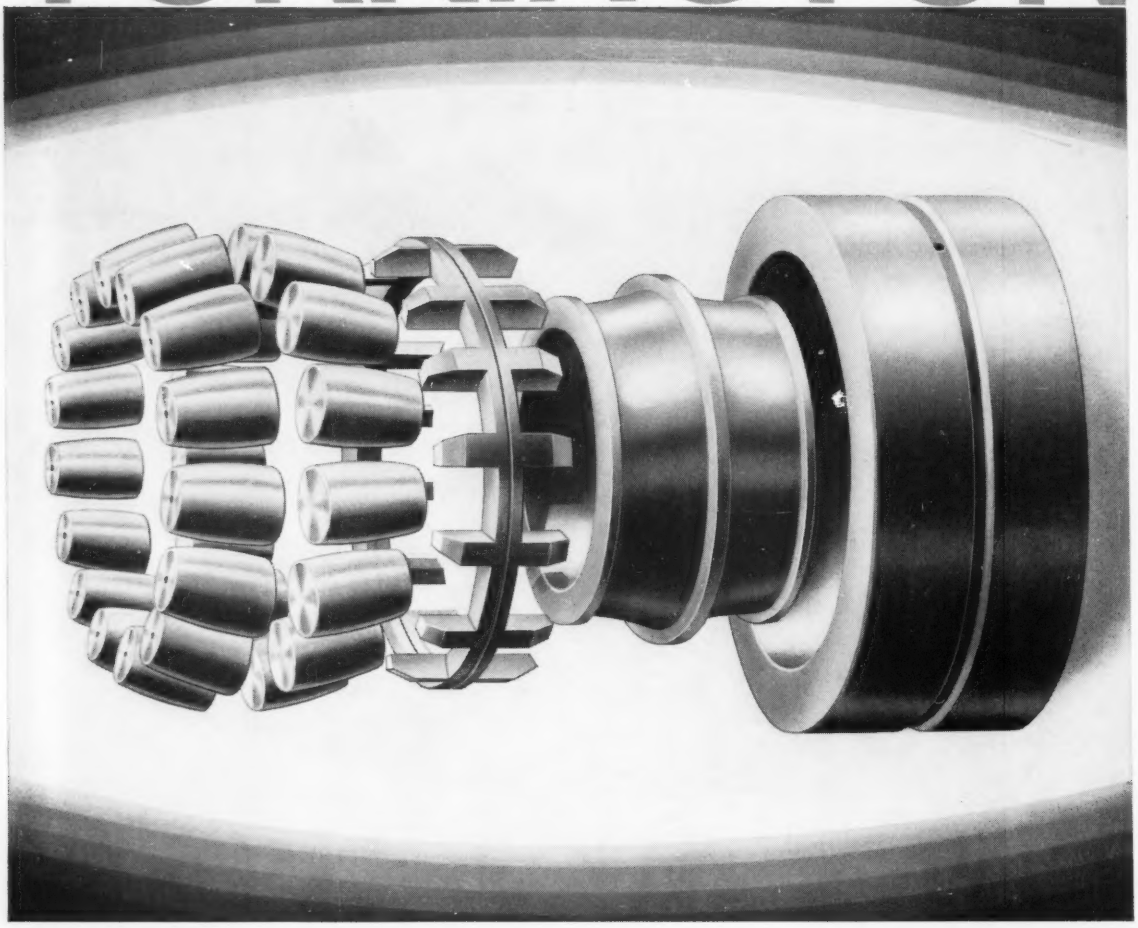

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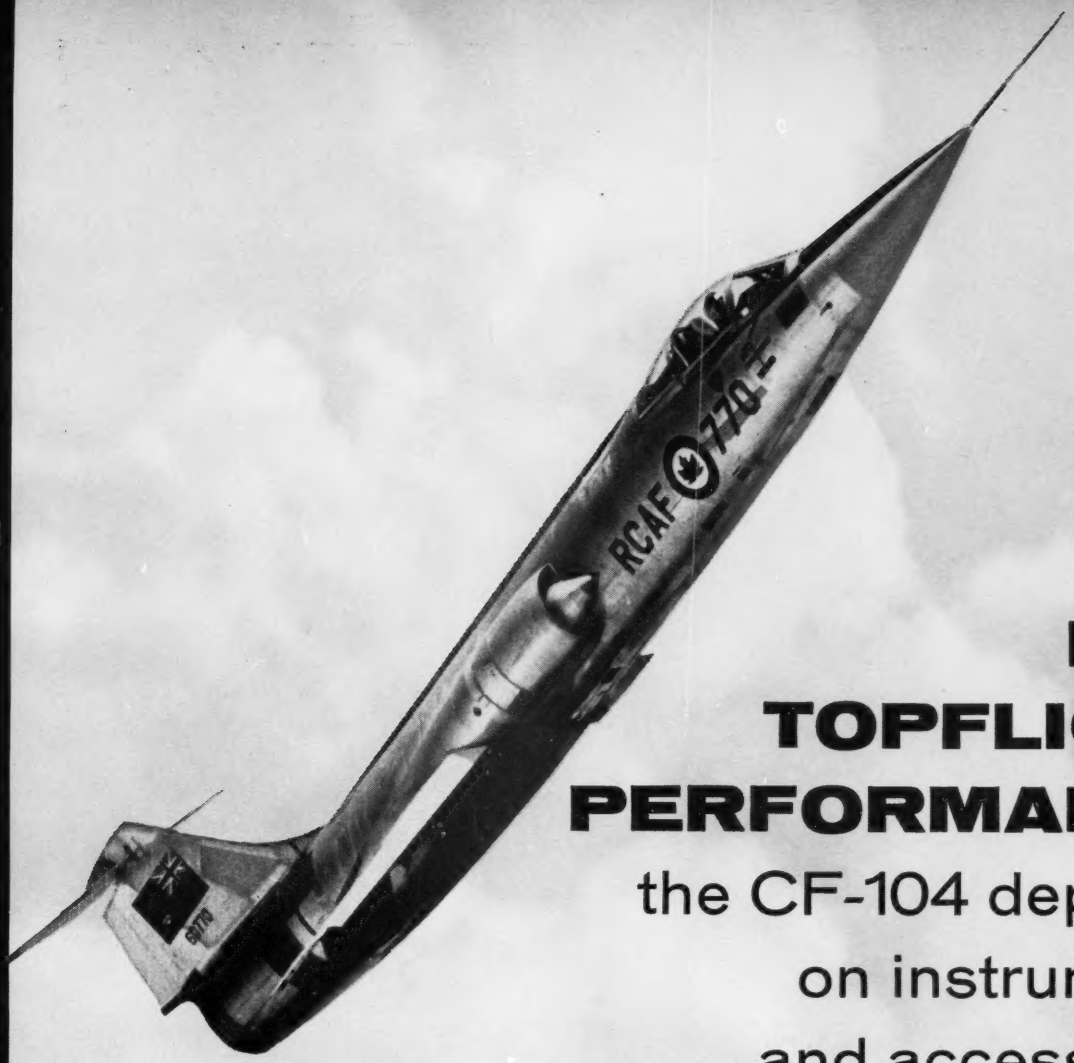


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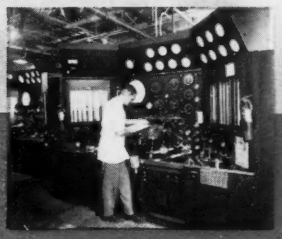

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In a test exposure to open flame, door seal made of HYPALON (left) extinguished itself as soon as fire was removed. Ordinary synthetic rubber seal continued to burn.

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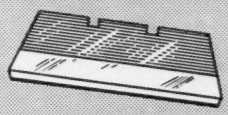

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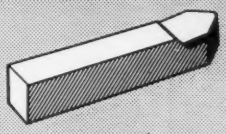

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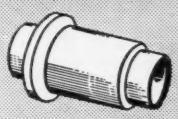

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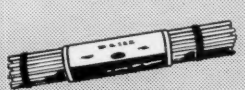

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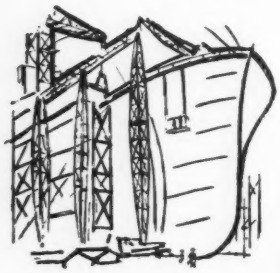

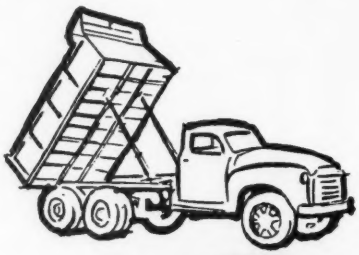

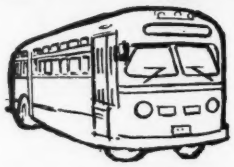

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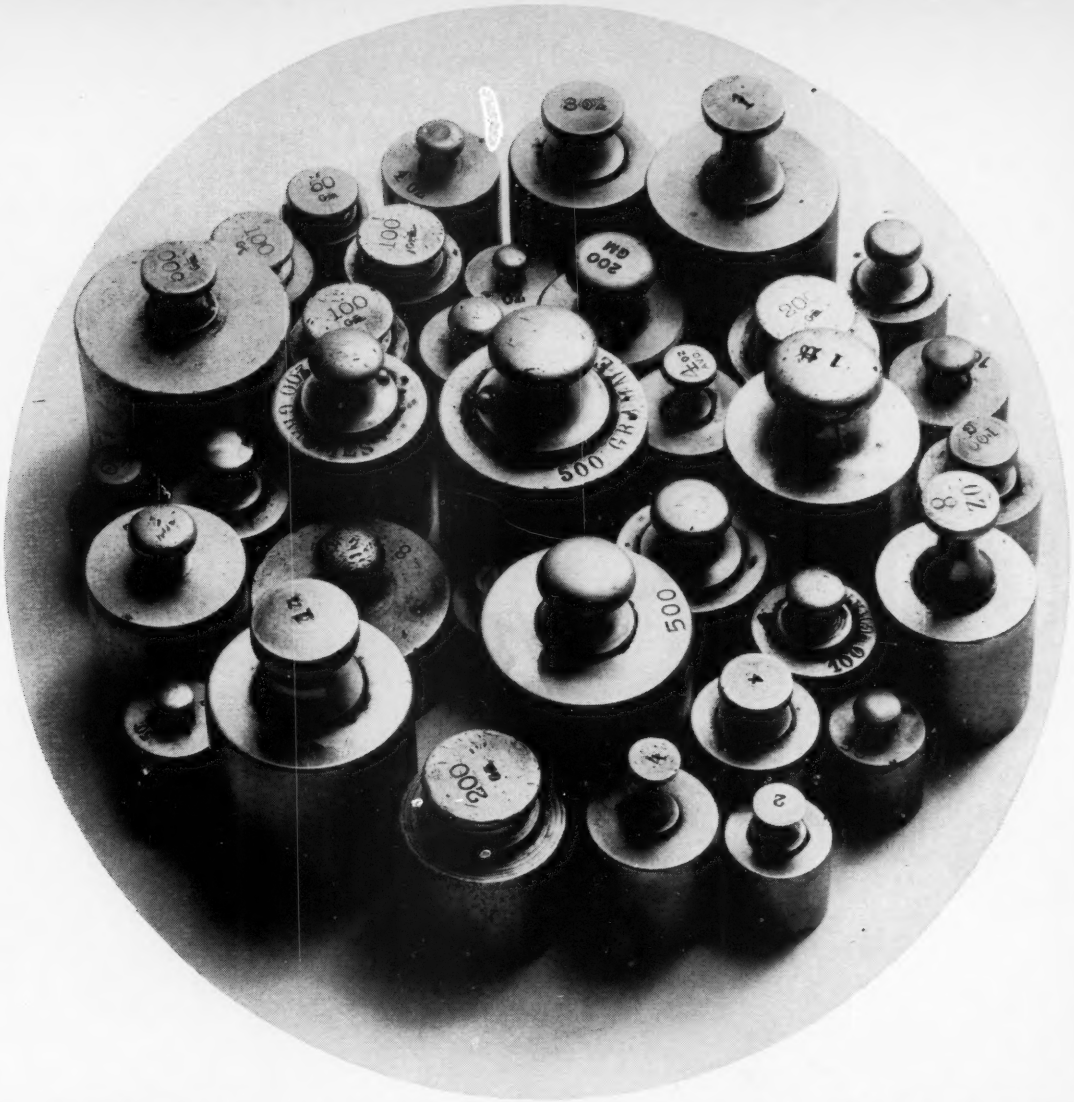


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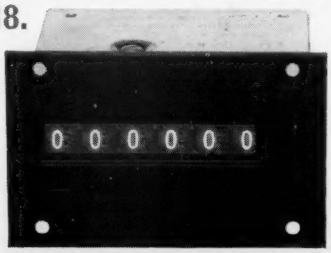


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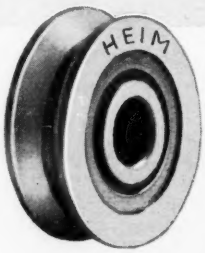


Heim's unique process produces a bearing with a full complement of balls, deep, unbroken, burnished ball grooves, with maximum capacity for radial and thrust loads.

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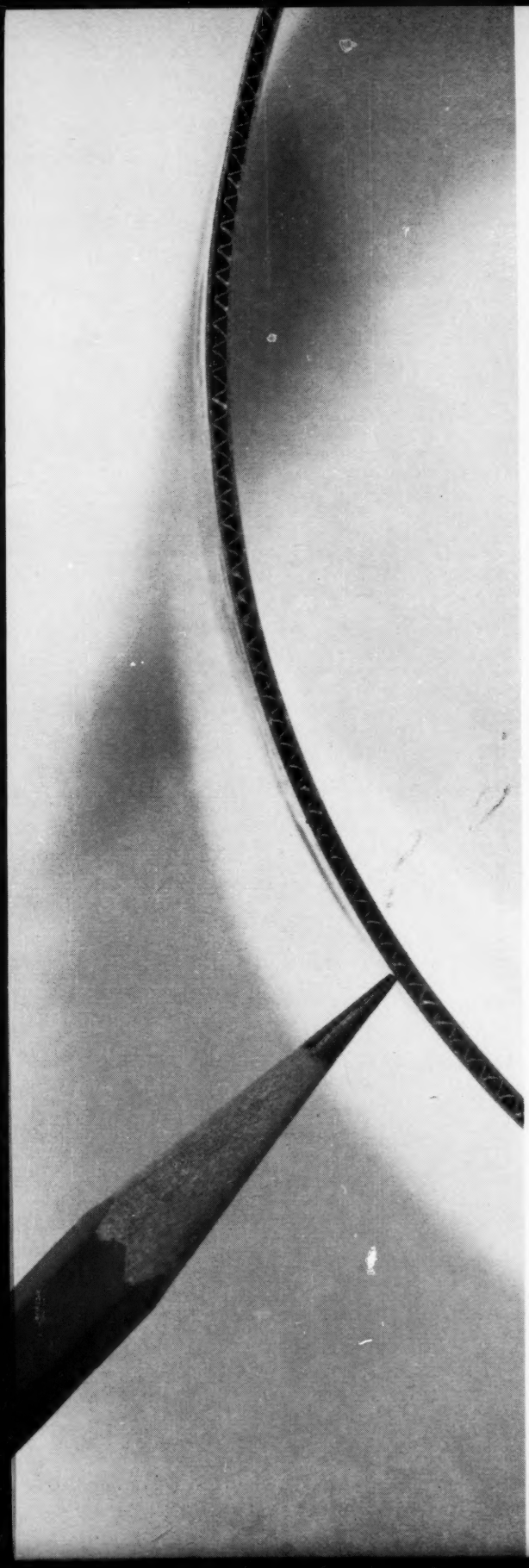


**Design Engineering**

**December, 1961**

# Vacuum brazing solves problems of miniaturization

Modern vacuum and hydrogen processes eliminate problems of cleaning, fluxing and distortion

***By Ken Campbell***

"Give us the materials to build lighter jet engines with increased thrust," has been the continual, urgent cry of the aircraft industry. In more recent years the missile and nuclear industries have added their pleas for materials to meet tighter and tighter specifications.

To comply, designers, metallurgists and scientists have had to contend with continually increasing temperatures and working stresses. New high-performance materials had to be found and the technology to work with them had to be developed.

One result of this intense development is the use of vacuum and hydrogen for brazing, sintering and heat treating.

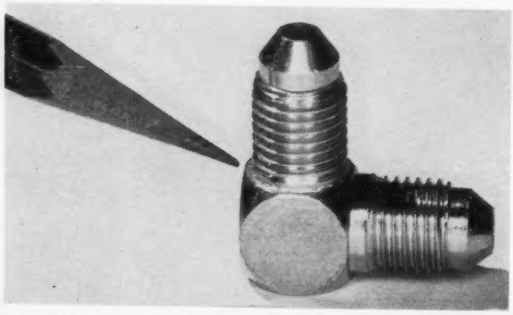
Vacuum and hydrogen processing are such new fields that few designers have had time to realize the commercial possibilities; but those who have are pleased. They have found that cleaning, fluxing and distortion problems disappear; that brazing is often more suitable than welding; that parts leave the furnace shiny bright—usually brighter than when they went in. They have found that stainless steel fasteners and fittings can be heat treated in hydrogen after all machining is done; and the hard-to-join metals and alloys such as titanium, Inconel and Nimonic are easy to join in a vacuum.

However, it is the possibilities in stainless steel fabrication that really catch the imagination. Stainless steel as thin as .002-inch has been successfully brazed, and extremely complex honeycomb and tubular structures of thin stainless steel have been fabricated. This suggests a fresh approach to the design of compact heat exchangers and other heat transfer devices. Many industries should be interested—refrigeration, automotive, air-conditioning and chemical equipment, to name a few.

Canadian Vac-Hyd Processing Ltd., in Oakville, Ont. is the only company in Canada offering vacuum furnace and hydrogen furnace facilities. Ross Pritchard, president, says, "Industry is just beginning to realize what can be done with these processes."

A visit to his busy factory gives the impression that industry certainly is beginning to realize what can be done. The 1,000-lb furnace is in constant use while

*Stainless steel assemblies being loaded into vacuum retort for brazing.*



*Top left: brazed flow tube assembly. Top right: Stainless steel honeycomb seal for jet engines. Bottom: brazed ss elbow fitting.*

men busily prepare the next lot for processing.

Besides providing vacuum and hydrogen furnace facilities for industry, Vac-Hyd takes on complete fabrication jobs. For this, metallic arc, spot, inert gas and oxy-welding equipment is on hand.

As president, Mr. Pritchard still finds time for research and development. A University of Toronto graduate, he spent a good part of his career as a research metallurgist for Orenda Engines, developing metal-joining techniques. Not long ago he developed a production method for brazing Zircaloy and other reactive metals used in the nuclear field.

Vac-Hyd's vacuum furnace (also ideal for hydrogen processing) is one of the largest of its type ever constructed. Although of recent and original design, it is a rugged, dependable machine. It is comprised of only three basic units—an electrically heated chamber, an oven or retort, and a pumping system. Nevertheless the difficulties of design were enough to give a designer nightmares. With a 42-inch diameter retort and a 40-inch working height, a vacuum of less than 1 micron has to be maintained at temperatures as high as 2250 F. and the temperature has to be kept uniform throughout the retort. It must have been very much like building a space capsule, the great difference being that with a capsule, space would be on the outside rather than on the inside.

The furnace is a "vertical" type, which means it is loaded from the top. The removable retort can be lowered into and hoisted out of the heat chamber. This is an important feature for production work. The retort can be transported to any part of the factory for loading, and as two retorts are used, one can be working in the furnace while the other is being loaded.

### Why vacuum or hydrogen?

Like every manufacturing decision, the simple and logical rule is to choose the method which will deliver adequate results at the lowest cost. Therefore if vacuum or hydrogen processing is not necessary it should not be used. If welding will give adequate results at the lowest cost, then welding should be used. If ordinary brazing, sintering and heat treating techniques are satisfactory then they should be used.

It is only when the ordinary techniques become too costly (because of cleaning, extra machining, etc) or produce inferior results, or simply will not work, that special methods should be considered.

Again a decision must be reached. Will processing in a protective atmosphere such as hydrogen be sufficient, or is vacuum necessary? This is where Canadian Vac-Hyd's specialized engineers come in handy; they can advise the manufacturer. Mr. Pritchard says, "This is an important part of our service. We are always ready to assist with metallurgical problems and offer suggestions in product design."

### Brazing did it

It used to be that brazed joints could not be used for high temperature applications. The filler metals were not up to the job. Today, thanks to protective atmosphere and vacuum brazing, nickel-alloy brazed joints are working at temperatures as high as 1800 F in jet engines and rockets.

A good example of what brazing can do is found in the 50-lb, 75-hp gas turbine developed by Williams Research Corp. for Ford's Army Jeep. The turbine blades of this husky little engine are vacuum brazed to the holding rings, and they have operated at 1600 F for extended periods without loss of joint strength or distortion.

Brazing, as defined by the American Welding Society, is "a process wherein coalescence is produced by heating to a suitable temperature above 800 F and by using a non-ferrous filler metal having a melting point below that of the base metal. The filler metal is distributed between the closely fitted surfaces of the joint by capillary attraction." This definition covers all types of brazing. The difference is between the methods used to achieve coalescence. This in turn depends on such factors as the chemical natures of the metals, oxidation, and the design and location of the joint.

Both vacuum brazing and protective atmosphere brazing help to eliminate the formation of oxides and to reduce those oxides already present on the surface of the material to be brazed. The disadvantage of an atmosphere in this respect is that many of the new high-performance materials contain alloying elements which produce oxides difficult to reduce in an atmosphere. In other cases the alloying elements actually react with the protective atmosphere to form gas metal compounds which lower physical properties of the base metal and interfere with brazing.

Because of this "gas pick up" some of the enhanced alloys, such as Inconel 700 and Nimonic 90, can be joined only in a vacuum. They are extremely difficult to weld and other brazing methods, using fluxes and protective coatings, have proven undependable. Vacuum brazing allows the use of valuable alloys which otherwise could not be used.

Fortunately gas pick up is not an important factor in most brazing, and a lower cost hydrogen atmosphere can be used with excellent results.

## Savings start with design

Vacuum brazing has special advantages which, if properly exploited, can cut costs and increase product quality. Since flux is not necessary and there is no unsightly formation of oxide, cleaning is avoided.

But as usual, it is on the drawing board where the greatest savings and improvements can be made. Because there is no danger of flux gas entrapment or warping (or side effects, such as lagging gaseous diffusion and back pressure which impair substitute atmosphere processing) extremely complex assemblies can be designed using thin stainless steel. For heat transfer devices this means the elimination of bulkier and less effective materials. Also, all brazing is done in one operation, and if necessary heat treating and degassing can be included.

A valuable result of vacuum brazing is that an area of vacuum can be "entrapped." This causes two main effects:

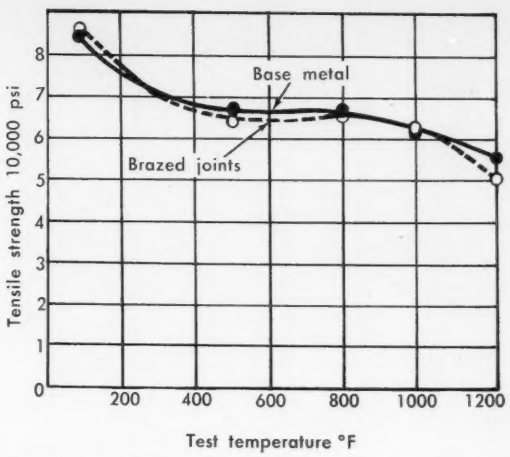
First, surrounding surfaces are subject to compressive stresses which can be utilized in the design of thin metal structures.

Second, the evacuated area provides first-class insulation.

An example of how the latter effect has been cleverly put to use is the "Dri-Hot Plate" made by Gaunt Steel Products of Toronto.

This double-walled hot plate is used by hospitals to keep food hot from kitchen to patient. Previously the two main sections were spot welded, but this allowed a hiding place for bacteria, and eventually steam caused the welds to give.

Not only did vacuum brazing eliminate these faults, but the vacuum entrapped within the double walls greatly improved insulation. The owner of Gaunt Steel Products had this to say: "I was considering silver soldering when I heard that vacuum brazing would do the job. I couldn't be more pleased with the results. Sometimes the Dri-Hot Plate is carelessly left on a hot stove. Now it doesn't matter. I can guarantee it up to 1600 F. It's almost indestructible."




*Tensile strength of butt joints brazed with Ni-Cr-B alloy is little different from that of AISI 347.*

Until now brazing has been the main use for the vacuum furnace, but this might not always be true. Vacuum sintering is also proving its excellence.

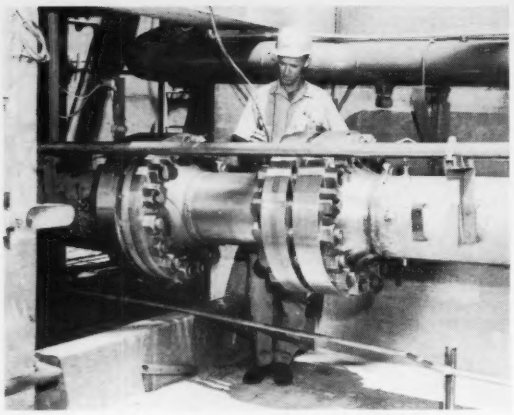
Discouraged by the relatively low physical strength of sintered parts, designers have often preferred costlier machined parts. Vacuum sintering does much to improve this situation. The discouraging physical strength has been attributed to imperfect sintering, resulting from the absorbtion of gaseous molecules and the formation of oxides on the tiny metal crystals being sintered. A vacuum removes the gases and oxides so that perfect sintering can be achieved. One test showed a 40% increase in crushing strength for vacuum over hydrogen sintering. The powder used was AISI stainless steel.

A vacuum allows the highest quality sintering, but is the highest quality necessary? Often it is not. Often the application requires heat-resistant or stainless properties rather than strength, in which case hydrogen sintering is generally adequate.

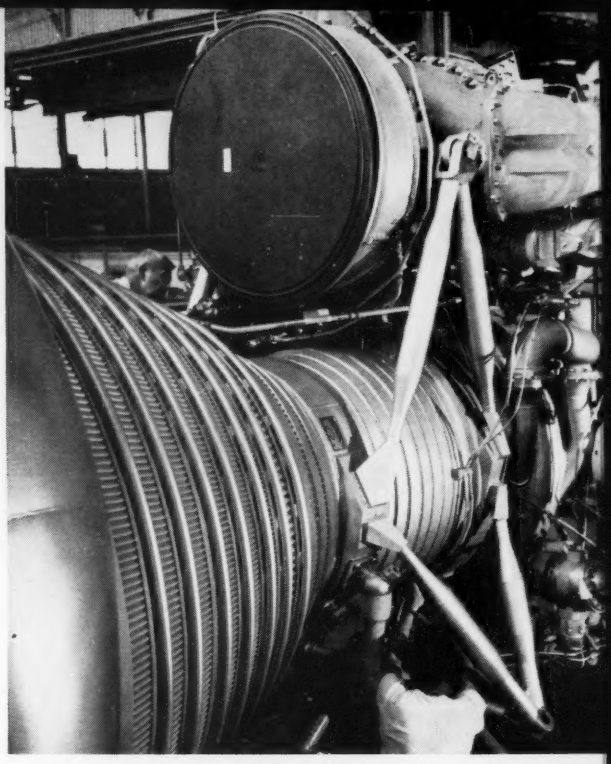
A steady increase in the use of vacuum processing is expected in the future. In connection with reactive metals, annealing of titanium wire and brazing of titanium and zirconium base alloys are regarded as promising fields. Also more work is expected in the brazing of extremely complex assemblies, such as heat exchangers and honeycomb panels.

Mr. Pritchard is careful to point out the importance of bright heat-treating stainless steels in hydrogen. He points out how stainless steel parts annealed by other methods are usually pickled after heat treatment . . . how stainless steel parts are usually rough-machined before hardening and then finish-machined after hardening to remove the oxide scale. Parts which cannot be machined after hardening, such as springs, are usually plated for protection.

All these operations, designed to find a way around the problem of scaling during heat treatment, are avoided if the heat treatment is conducted in a hydrogen atmosphere. Says Mr. Pritchard: "I'm sure that bright heat treating is something Canadian design engineers would like to know about. It's something many of them should be using right now." ★



*Fourteen inch flowmeter measures rocket fuel.*



*F-1 engine slated for moon probe.*

# Flowmeters test moon rocket

How much fuel and oxidizer will it take to get the Apollo space ship off the ground to carry a three-man crew to the moon and back? The answer should be provided from tests being conducted right now.

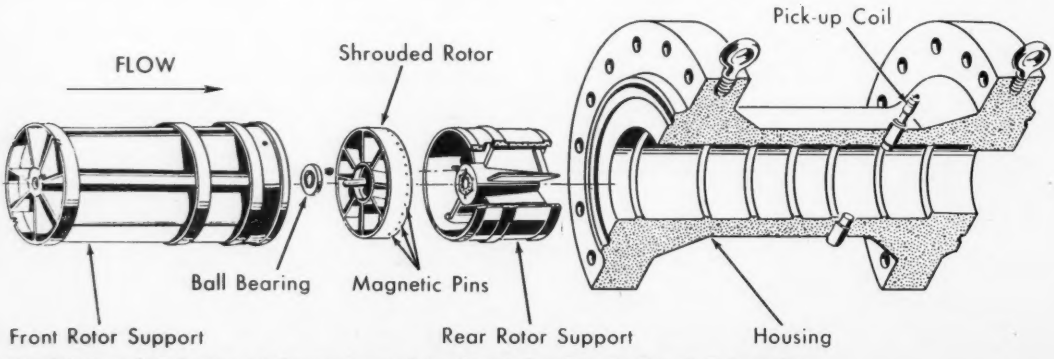
Turbine-type flowmeters, engineered and built by Fischer & Porter Company, have been given the task of measuring flow of liquid at rates up to 30,000 gallons per minute. They are gulping liquid oxygen and rocket propulsion fuel at these rates during brief tests of the F-1 rocket engine.

Although a test may take only 1¼ seconds, the flow goes from zero to full rated and back again in that time. The 14-inch stainless steel flowmeters, therefore, need their extremely high capacity to give engineers a precise idea of what fuel flow will be when eight F-1's in the space ship are in simultaneous operation.

In a test, the fuel constituents enter the upstream connections and pass through special flow straighteners that minimize the effects of upstream piping. A sharp-edged orifice increases the effects of turbulent flow to afford longer linear-flow measurement ranges.

When the fuel enters a controlled-area metering section it turns a shrouded bladed rotor of stainless steel. Rotation of the shroud, which contains magnetic stainless steel pins, cuts through a magnetic field, inducing a pulse in the pick-up coil which surrounds the magnet. Since rotor speed depends on flow, pulse frequency and voltage are proportional to this flow.

The meters operate at 2500 psig. Temperature of the liquid oxygen is about —300F. The meters are designed for a range from below —300F to 700F (for molten metal applications) without secondary coil cooling. They are actually standard meters beefed up to withstand the great pressure drops and heavy shock loads demanded by the great volumes of fuel being rammed through the system. ★




*Simplified exploded view of flowmeter used in thrust chamber studies of F-1 engine.*

# Four-step procedure simplifies and speeds design of automatic machines

Here's how easily it's done . . . using the latest techniques . . . for a rotary index machine

**By Raymond H. Dipple**

The planning of any automatic production sequence comprises a number of engineering functions performed in an ordered rotation. The process engineer, tool engineer and machine designer all contribute their specialized experience.

Often the required output per hour from the proposed machine is specified. The problem is to consider all possibilities and finally determine the exact form which the machine should take. Initial development follows a four-step pattern:

1. Operation sequence
2. Tool layout
3. Fixture layout
4. Machine layout

While this work is proceeding decisions are made on the control systems, both fluid power and electrical.

The entire work is carried out in a restricted time period since it is performed solely for the purpose of quotation. The all-important conclusions reached form the basis for estimation of price and delivery date. This article describes, as a typical design assignment, the planning of an automatic rotary index machine intended for drilling, reaming and chamfering automobile connecting rods.

## Operation sequence

This sequence is a detailed list of each individual cutting operation. To a certain extent it may be permitted to override the official operation layout for the workpiece, should it be found that practical, economic or other circumstances indicate a revision.

A review of the sequence together with component design establishes whether it will become necessary to index, roll over or otherwise orientate the component during the machining cycle. From this operation sequence, tentative information such as number, type and complexity of each station may be obtained but further development must be in the form of drawings.

## The tool layout

The tool layout is a layout of the total tooling on the machine. Since at this stage only an approximate idea is possible of what the finished machine will look like, this layout can only indicate tooling as proposed for each individual station. The drawing comprises a collection of individual station layouts. These layouts must be complete in themselves but need not necessarily be in sequence order, since modification may become necessary as the work progresses.

Relevant data is calculated and added to the drawing. Length of feed strokes are indicated, including allowances for pretravel and overtravel. Sizes of all drills, reamers and chamfer tools should be shown. Views must indicate necessary tool holders, guide bushings, etc., since these may influence fixture design. A check should be made to ensure tooling will clear workpieces as these index from station to station.

Optimum feeds and speeds are decided at this stage, thus permitting horsepower requirements to be ascertained for each station. It is good practice to gain an idea of machining thrusts where these are obviously heavy, as would obtain with the use of multiple spindle heads. Torque should be figured for each input shaft.

Sufficient information has now been compiled for cutting times to be calculated for each station. Having completed the tool layout thus far, time should be taken to study the result of the work and its implications.

## Design for cycle time

Of paramount importance is cycle time and capital cost. The production rate required is known which will dictate the cycle time required of the machine. The cycle time for each station must be equal to, or less than, the cycle time of the machine. Station cycle times should be closely matched for economical operation. It is often undesirable to include a separate station for a very short operation. The tool layout should be studied to check the possibility of combining the short operation with another, so decreasing the total number of stations required and perhaps reducing the cost of the machine. The operation sequence may need revision or a decision made to exclude the short operation altogether. It is sometimes economical to provide a separate general purpose machine elsewhere in the line.

At the other extreme is the problem of the extra long operation, since the cycle of events of the entire machine must wait upon the completion of the slow member.

A too long cycle time is intolerable and the trouble must be overcome. Often slow drilling operations involving large diameters, or deep holes requiring constant back-out to clear chips, may be divided, so that holes are partially drilled at one station and subsequently indexed and fed to depth at another station or stations.

Slightly long cycle times are usually no problem. Speeds and feeds can often be increased to take care of the discrepancy; if necessary by modifying cutting tool grades, fixturing and so on to make this practicable.

The calculated over-all cycle time of the machine is a theoretical 100% and becomes the gross production per hour. This figure must be reduced by 20 to 25% in order to arrive at a value more compatible with that

likely to be obtained in practice on the shop floor. If this figure compares favorably with the required production per hour, everything is in order.

Should the machine overproduce, speeds and feeds could be reduced to gain improved tool life. Where appreciable overproduction is obtained a detailed revision of the operation sequence may become desirable, with a view toward modifying the whole design concept. However, where a carefully prepared tool layout has been adhered to, this contingency should not ordinarily occur.

Production requirements are sometimes double the proposed machine capacity or even more. Here the quotation would be for two or more identical machines whose combined outputs would produce the required figure.

## The fixture layout

The experience gained from the tool layout together with familiarity of the component will probably have suggested several methods of fixturing.

A rough layout should be made showing location points and clamping possibilities. The fixtures should clear all tooling as these pass from station to station.

A major section of the work entails appropriate provision for loading and unloading in terms of the cycle time already established. If this time is a minute or longer it is probable that the operator will have ample time to load and unload manually and still have opportunity to gauge workpieces or clear chips.

If less than a minute the effect of operator fatigue must be considered and the job facilitated by the provision of hydraulic or pneumatic clamping. Special attention should be given to ensure trouble-free fall away of chips.

Where the cycle time is less than about 15 seconds loading may become a problem and some form of automatic system may become necessary. The result of this thought should be reflected in the fixture design.

The type of machine will have been suggested by the tool layout. Accordingly the fixtures should be laid out on a suitably sized circular table taking into account the number of fixtures required. Figure 2 shows the fixture layout and since the cycle time is 24 seconds, hydraulic clamping is called for.

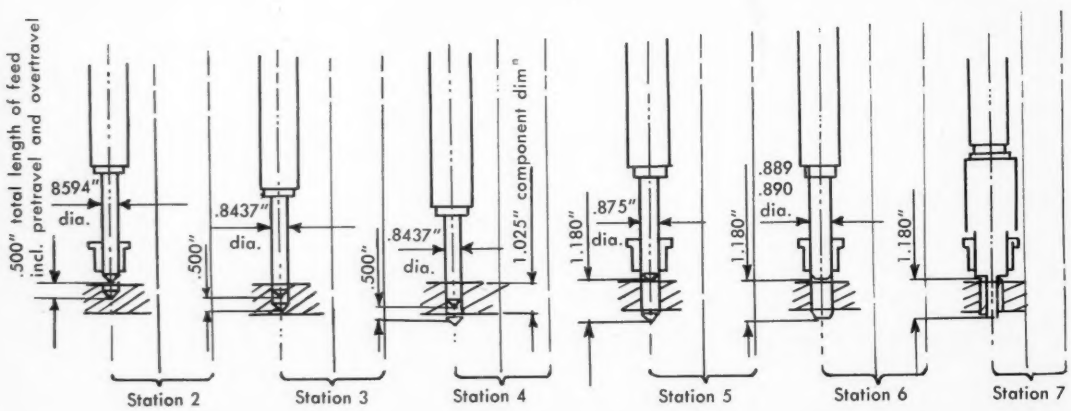
This concludes work on the fixture layout since sufficient information is now available to permit the preparation of the machine layout.

## The machine layout

The machine layout should consist of a floor plan and, if necessary, one or more elevations, about one-eighth scale, using data already established. In addition tool change cabinets and equipment proposed for handling chips and coolant supplies should be indicated. Data must be available on size of hydraulic power units, pneumatic equipment and electrical control cabinets. The design of hydraulic and electrical equipment is a specialist responsibility within the plants of leading machine tool builders. These departments estimate suitable floor space to assist with the preparation of the machine layout.

Miscellaneous details include a lubrication system, automatic or otherwise, to conform to customer's standard practice or the machine builder's recommendation.

Finally a routine check is always made to ensure operator and tool setter are given ample working area in which to discharge their respective duties both safely and efficiently. ★




| | Station 2 | Station 3 | Station 4 | Station 5 | Station 6 | Station 7 |
|---|---|---|---|---|---|---|
| rpm | 222 | 227 | 227 | 222 | 172 | 170 |
| sfm | 50 | 50 | 50 | 50 | 40 | 50 |
| fpr | .009 | .0087 | .0087 | .020 | .026 | .024 |

| | |
|---|---|
| Rapid advance | 2.4 secs. |
| Machining time | 15.6 |
| Rapid return | 2.4 |
| Index | 3.0 |
| Total cycle time | 23.4 secs. |
| HP Req'd 20 | |

| | |
|---|---|
| Rapid advance | 2.4 secs. |
| Machining time | 15.6 |
| Rapid return | 2.4 |
| Index | 3.0 |
| Total cycle time | 23.4 secs. |
| HP Req'd 15 | |

Load time absorbed in machining time.

Production per hour 153 pieces at 100% efficiency.

*Figure 1. Most important factor in designing a special production machine is determination of cycle. Here's the one discussed in article.*

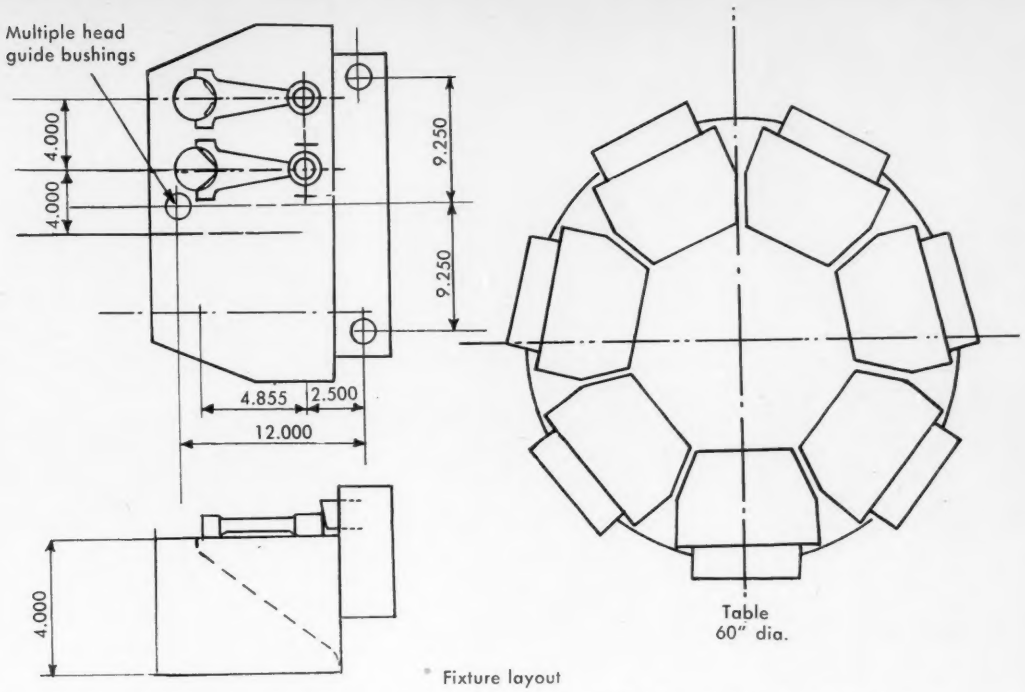



*Figure 2: This fixture layout, designed for 24 second cycle, calls for hydraulic clamping of workpiece.*

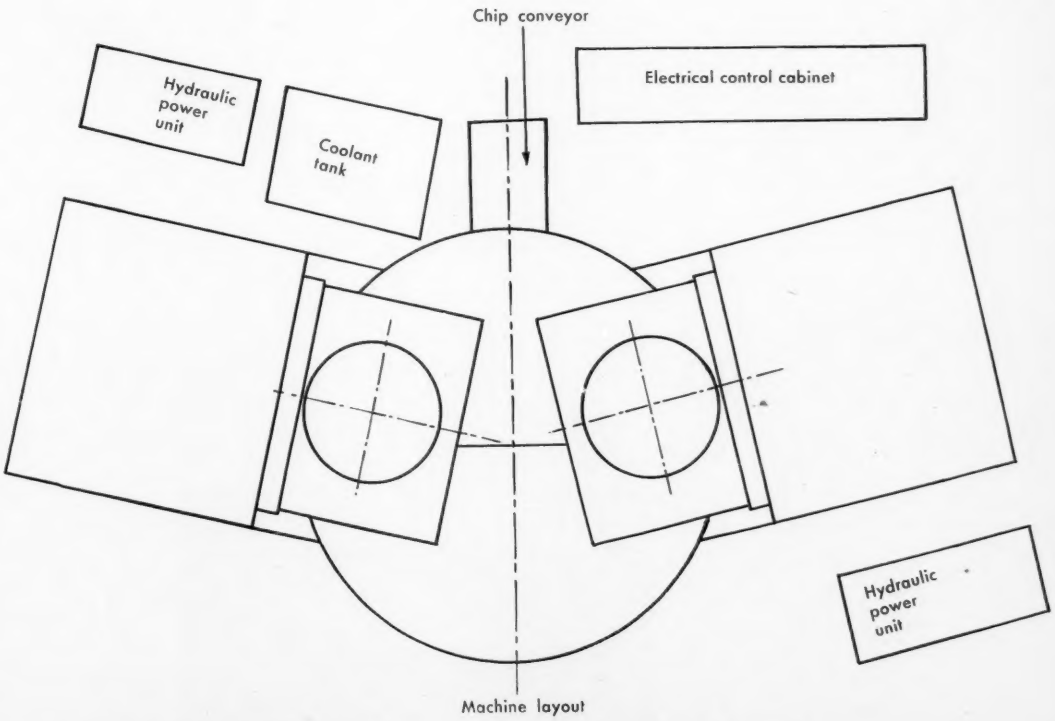



*Figure 3. Machine layout includes floor plan and one or more elevations as required .*

# Stainless Steel Branch Bank Design Award winners

*Howard Chapman and Len Hurst with their branch bank model which won first prize in stainless steel design contest.*

**The Toronto firm of Chapman and Hurst won first prize of $5,000** in the Stainless Steel Design Competition for the best design of a branch bank (see DE, June and July issues).

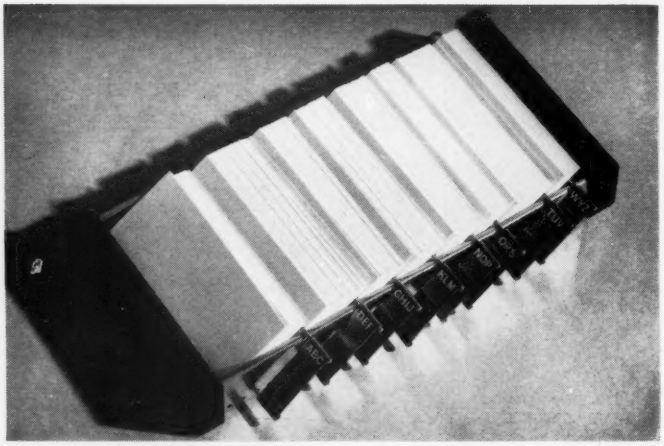
The entries in Category 1, described by the jury as being of the highest quality, came from all parts of Canada and included models, drawings and reports. Second prize went to a group in Niagara Falls, while third prize was divided equally between another Toronto firm and one in Vancouver.

The results in Category 2 were, according to the judges, an entirely different story. Here are some of the things they had to say:

"The jury noted with regret that so few professionals competed . . . in a majority of submissions the designer had little knowledge of stainless steel or its potentialities . . . severals designs were impractical . . . prohibitively expensive . . . no evidence of creativity on the part of the designer . . . "

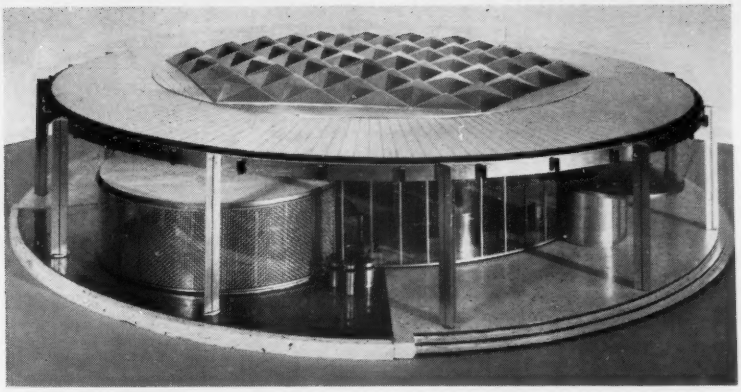
The jury took great pleasure in examining the card file which won first prize in Category 2 for Lawrie McIntosh, B.A.Sc., M.S., A.P.I.D., P.Eng. It was an original idea, well worked out, and stainless steel was eminently suited for the application.

The judges were not so complimentary about the other award winners. They expressed doubts about a trend for obscuring so beautiful a material as stainless steel with color of any kind, even though they awarded such an item third prize. It was immediately obvious to all who saw the entries made in Category 2 that Canadian designers, as represented in this competition, were anything but professionals.

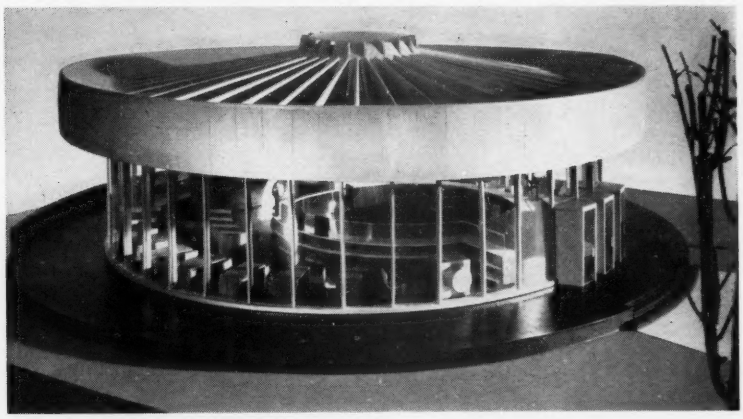


*Business card file designed by Lawrie G. McIntosh won first prize in components and accessories section.*

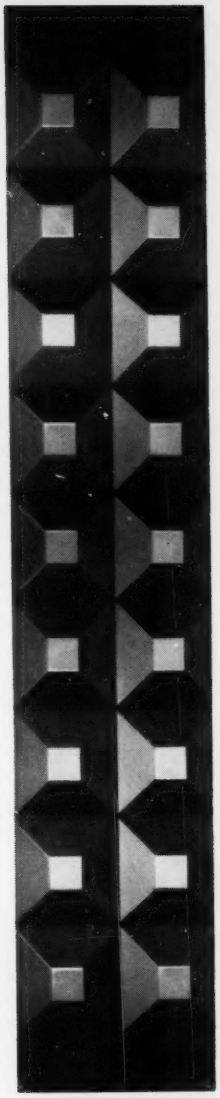
*Geodesic pattern afforded good utilization of stainless steel.*



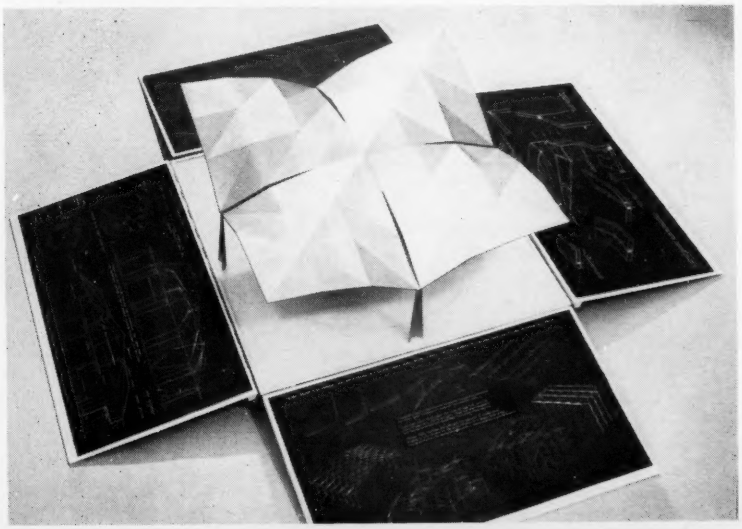
*Showing imaginative use of stainless steel, this design by J. A. Szarvas, A. G. Zimmerman and B. Meredith stood second.*



*This model took third prize in bank design. It was developed by Toronto architects Lipson and Dashkin, with designer Ensor assisting.*



*Not an award winner, but excellent use of stainless.*



*Ingenious edge locking structural panelling system won prize for John Ensor, industrial designer, in Category 2 of contest.*

# How to protect plant equipment from corrosion at lower cost

An economical combination of stainless steel foil and epoxy resin beats corrosion, at the same time eliminating many of the disadvantages of encapsulation

Adding the corrosion resistant properties of stainless steel to plant equipment has now been made possible with very little increase in cost. The process can not actually be referred to as cladding, metallizing or plating, yet it gives a less costly, longer-lasting result.

Stainless steel foil is used as the mold for a casting of epoxy resin. The product being protected is embedded inside the resin, sheltered from mechanical injury and the surrounding environment. The resin provides mechanical support, while the stainless foil protects against corrosion.

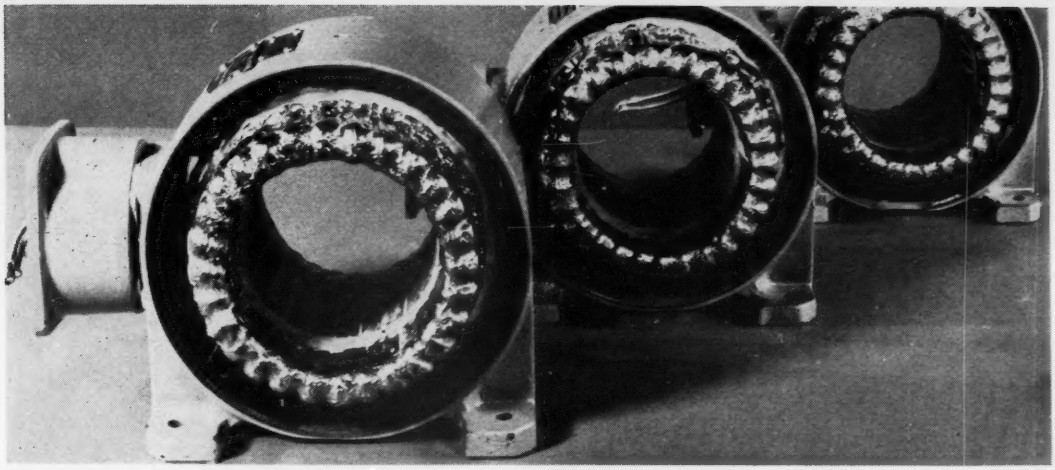
Essentially, the process adapts the electronic industry's encapsulating technique for "potting" electronic components. Electrical engineers encapsulate to protect sensitive circuits and components from moisture, corrosion, air-borne-dust and fungus.

The Epoxylite Corporation, El Monte, California, which developed the process, terms it an extension of earlier work that resulted in the first encapsulated electric motor. Epoxy encapsulation protects the magnetic wire of the motor against moisture, dirt, and attack by some chemical agents.

Despite the advantages of the encapsulated motor, reports Epoxylite, such designs also hold several disadvantages:

- Encapsulation is expensive, because of need for permanent molds with high tooling cost.
- Production cycle is slow (up to 8 hours per opera-

*Stainless foil, .002 in. thick, and preshaped within mold, fits over product. Epoxy resin is poured between stainless shell and product.*



*Combination of plastic casing and stainless steel foil gives electric motors benefit of alloy's superior corrosion resistance.*

tion), and mold removal can be time consuming.

- Too much epoxy resin is needed, since permanent molds can't be designed for least epoxy and also prove suitable for motors of different sizes.

- Epoxy resins suitable for encapsulation work have good corrosion resistance, but fail quickly when exposed to some common corrosive environments.

At a decrease in product cost, stainless steel foil corrects all disadvantages of the standard encapsulated motor.

## Cast in stainless foil

The new process uses .002 inch thick stainless steel foil as the molds. After molding, the stainless remains in place and the encapsulated motor thus functions as a canned motor. It is completely sealed in a thin, light-weight envelope of stainless steel which extends over the windings and through the motor bore.

The natural adhesiveness of epoxy assures complete bonding at the stainless/resin interface. Overlapping seams in the stainless envelope, through which a corrosive agent could penetrate, are joined by another epoxy adhesive (one not suitable for encapsulation) compounded for maximum resistance to chemicals.

The foil, backed by epoxy resin, is for all practical purposes mechanically indestructible. In the unlikely event that the foil ruptures, the epoxy underlayer provides corrosion resistance at least equal to existing encapsulated motors.

Long corrugated strips of stainless foil, overlapped to form circles, are trimmed to the size of the motor. An epoxy paste adhesive seals them to the stator iron at each end. Another strip of 2-mil, non-magnetic stainless steel foil may be glued to the stator core to provide more protection at this point.

A rubber bladder inserted and inflated in the core supports the stainless steel foil strips against the gravity head of the encapsulating compound.

A pouring spout is installed and liquid epoxy compound is poured into the stator, completely filling it. Curing to solid takes about 45 minutes, after which the bladder is removed. The stainless strips serve as closely-fitting molds for the epoxy resins during pouring and curing, and remain as permanent shields for complete motor protection against chemical attack.

## Insulation is complete

Epoxylite claims its encapsulation technique, with stainless foil, gives properly designed motors complete insulation (even in contact with Freon gas) under total immersion and under the most severe environments.

Non-magnetic stainless steel avoids distortion of the motor's magnetic flux, increasing operating efficiency. Foil is spaced from the windings by glass cloth and by the epoxy resin, both insulators. The stainless sheath can be positioned a few thousandths of an inch from the current-bearing copper, without danger of a short circuit.

"Canned" motors especially designed for submerged duty or extreme environments are expensive to build and hard to maintain. However, stainless encapsulated motors offer no unusual maintenance problems, cost no more than those embedded in epoxy alone, and in fact are priced only between five and fifteen percent over motors completely unprotected.

## Broad design prospects

Product engineers and industrial maintenance men should find even wider use for the technique, so long as sufficient floor space is available for a negligible increase in equipment dimensions. This is obtained without use of heat and without use of noxious or unsafe liquids.

But there are several things the stainless/resin casting is not.

First, at present, the end product lacks the characteristic lustre of stainless steel. The stainless foil wrinkles.

Second, foiling the product in stainless does not impart the strength and toughness of the solid metal. The foil/resin system does withstand abrasion and impact to an astonishing degree, but can be ripped and torn to expose the softer epoxy resin underlayer.

And finally, space limitations can preclude protecting equipment with stainless/resin combination, however desirable it may be for service.

*Robert Kipp and specific gravity separator which has found world-wide market.*

# Kipp Kelly is designing world beaters

To milling and mining people in Tanganyika or Russia the name Kipp Kelly would mean more than in Winnipeg. Here's another Canadian success story.

**By Dudley Magnus**
*Winnipeg*

***A design profile***

Bits and pieces sticking out here and there in factory machinery didn't matter too much in past years, so long as the machinery did the job.

Today, business managers and factory owners are growing up and insisting on attractive designs. The old bits and pieces are out.

This is the opinion of Robert Angus Kipp, one of Canada's best-traveled and most wide-awake manufacturers. His company makes separating machinery for scores of different types of businesses, and sells it throughout the world, even behind the Iron Curtain.

Last year Kipp, president and managing director of Kipp Kelly Ltd., Winnipeg, issued a public statement to Canadian industrialists charging that Canada was existing in a "bad state" of economic imbalance.

He said Canadian investors had not kept pace with their U. S. counterparts. "We prefer to sit back and grouse about Americans taking advantage of the tremendous investment opportunities that are available."

Economically built but tasteful, eye-pleasing design is enough for Canada to grab a share of the wide-open market in underdeveloped countries, says Kipp. Later, he forecasts, Canada will have firmly established trade links with these countries.

"But you can't export any old thing to them. They won't buy a second time if they see a better design elsewhere." His basic design secret: "When planning a machine, make your shell first, then try to have the works fit into it, rather than vice versa."

He believes North American manufacturers have lost sight of design in their desire for ever-increasing mass production at lower cost. He is certain good design *is* possible at lower cost, because of its inherent simplicity.

"Once you have a good design costs cease to be a factor. This is because the good design, being simple, is simple to produce. It's finding the good design in the first place that poses the problem."

A company should hire at least one engineer "of a different type," Kipp recommends. "He must have design taste, and should be an artist as well as an engineer. You can't just dream up design; it has to be in someone."

Kipp Kelly makes and exports separating machinery for mining, construction, food and agricultural industries, in about 60 countries.

The company spends little on advertising. However, Kipp himself is a personality. In 1953 he became president of the Royal Winnipeg Ballet. One of his top executives was chairman of the ballet's publicity committee. Both the ballet and Kipp enjoyed a constant, excellent press.

When an article by him appeared in Maclean's Magazine in 1957 entitled "My Strange Encounter With

The Diamond King," few local businessmen hadn't heard of him. The article followed the most famous expedition Kipp has made to install machinery—to the diamond mine at Mwadui, Tanganyika. Samples of diamond concentrates could not legally be sent to Winnipeg, so he made the trip to the concentrates.

Accompanied by four testing machines, Kipp left home in 1951. His job: find out if a machine could separate diamond concentrates. The diamond king, Dr. John Williamson, now dead, was reputed at the time to be one of the world's richest men.

Natives were used then to extract the diamonds from rocks. Williamson computed his losses due to pilfering and human error, and decided there must be a better way. A Kipp Kelly machine proved to be the answer. It operated on the air flotation principle, and left no diamonds in the rock.

When Kipp returned to Winnipeg, he spoke over radio stations, wrote articles, and addressed dinners and luncheons. The image of Kipp Kelly as a world-wide distributor was enhanced, at little expense.

The company traces its history to 1913 when Kipp's father, a U. S. milling engineer, started it in Winnipeg.

With such a father, Kipp had adequate training and at 22 was appointed export manager of the company in 1936, after groundwork training as an apprentice. In 1937 he journeyed to England to take a post as managing director of Separations Engineering Ltd. (The name was later changed to Kipp Kelly (London) Ltd. He spent 2½ years in Europe and the Middle East handling specialized machinery and its installation.

When World War II ended, Kipp Kelly Ltd. had a world-wide reputation for its separation machinery. Its main lines are the air float stoner and the specific gravity separator. They employ a dry process which separates stones, glass, metal (magnetic and non-magnetic) and all dangerous contaminations from milled food products. The machines operate on the weight difference principle.

The company claims the separator produces an action so sensitive that the tiniest particles of contamination are removed easily. It has an operating capacity of 15 tons per hour.

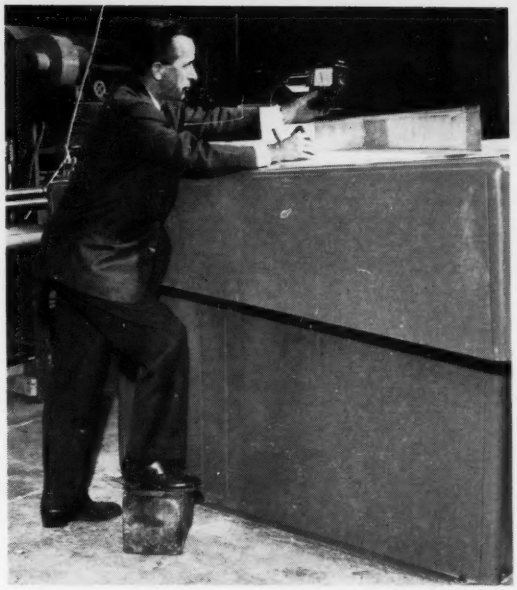
Kipp Kelly has agents all over the world and promises prospective clients free tests in its large Winnipeg laboratories. Thanks to this marketing strategy, plants throughout the world use Kipp Kelly's air float stoner for processing flour, peanut shelling, grain, seed, and scores of other foods and feeds.

The company's air float separator is used extensively to purify by dry concentration a wide variety of minerals including chromite, bauxite, mica and manganese.

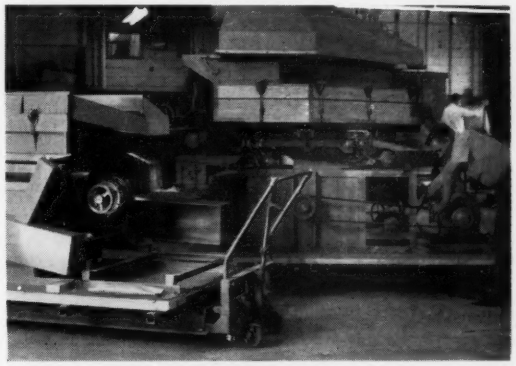
The electrostatic separator sorts out dry materials having different electrical susceptibilities. Using gas-filled electrodes for sharper separations, it can handle up to 5,000 lb of material an hour.

In April, 1958, Kipp once more went far afield for business and knowledge, this time, accompanied by Sol Kanee, president of Soo Line Mills Ltd., Winnipeg. At this time, 40 countries were using Kipp Kelly machines. Kipp was determined he would add a 41st.

For 15 days the pair toured Russia, with the official blessing of the Canadian Department of Trade and Commerce. A short while before the trip, Russian industrialists had made a similar trip to Canadian mills. Though Kipp knew none of the prospects on his list beforehand, he managed to sew up a sizable order for machines. His customers: the Russian grain trade. He had his 41st country—but count today is closer to 60. ★



*Checking performance of new separator prototype. Design provides for air flow control under all types of conditions.*

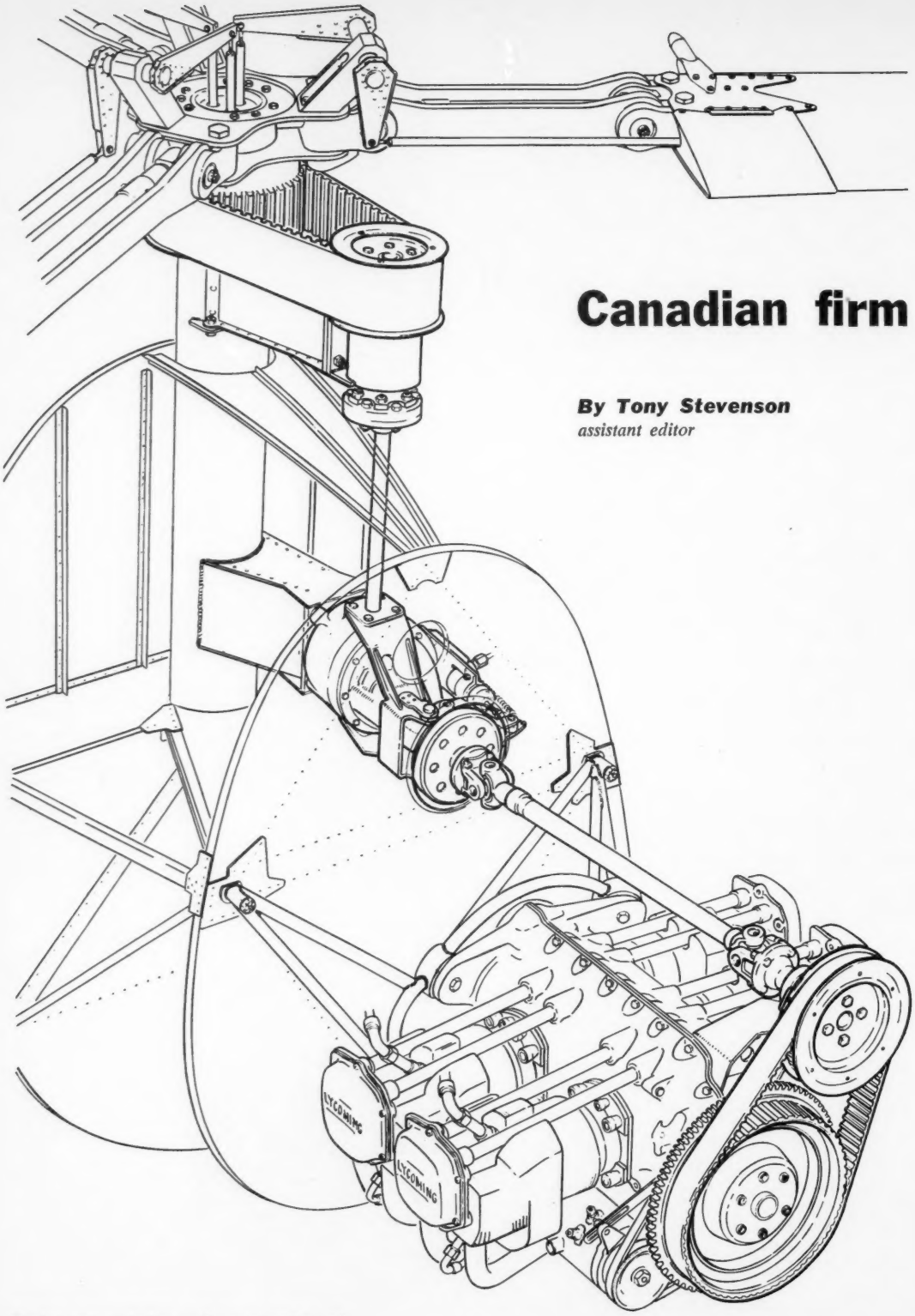


*Air float stoner, foreground, shells peanuts or sorts grain. Separator, behind, can check milled food products for foreign matter.*

*Kipp discusses design with assistant chief engineer Claude Levinthal.*

# Canadian firm

**By Tony Stevenson**
*assistant editor*




*Engine, transmission and rotor system of Avian autogyro incorporate several new design features. Stainless steel straps connect rotor blades to hub.*

Designers of the Avian aircraft have come up with a product which could play an important role in the future of Canada's west. At the same time they've ironed out some of the bugs which have plagued helicopters

# pioneers autogyro design

Designing safety into rotary winged aircraft is the goal set by Avian Aircraft Limited, Georgetown, Ontario. And the company, which began with a group of four aeronautical engineers in 1958, may have the answer in its latest pre-production prototype of a gyroplane.

Ever since the Spanish engineer, Juan de la Cievra, began experimental work on rotary winged aircraft forty years ago there's been a grave doubt in the public's mind as to their safety. Unfortunate experiences with helicopters in the past number of years have not helped to improve the position.

Any advances toward safety that have been made are due mainly to work on gyroplanes which have one important disadvantage — they can't hover. But they are useful for jump take-off and landing and have a greater range in horizontal flight. They are also safer.

The main difference is that a gyroplane's rotor is free spinning while the helicopter's is power driven. Thus the gyroplane relies on its horizontal thrust, as well as the spinning rotors to lift it off the ground. If the engine fails, the gyroplane's free-spinning blades autorotate allowing it to windmill safely back to the ground for a cushioned landing. A helicopter has to be higher than 250 ft. to allow its rotor to be disengaged and begin autorotating. Otherwise it crashes.

### No ground resonance

Avian has made its gyroplane even safer by eliminating another danger area. When a helicopter is within a distance from ground equal to half the diameter of its rotor system its blades begin to oscillate violently. This is the result of ground resonance caused by incompatible frequencies emitted by the chugging motor and the whirring blades.

The Avian craft uses stainless steel straps to link the blades to the main hub. These allow the blades to move freely in the most natural manner. The blades are also designed for extra stiffness to guard against unnecessary flapping. They comprise a high tensile steel spar which is hollow, counterbalanced on the leading edge by solid steel rods running from the root to the tip. This is filled in with spruce and balsa wood and topped off with fiber glass. In none of the 140 experimental flights has there been any evidence of ground resonance.

Driving the rotor system, prior to take off, requires some ingenious designing if the chore is to be made simple for the pilot. It all centres round the rotor pitch lever. With brakes on and the throttle one third open the rear propeller is revving. The pilot fully depresses the level to engage the clutch, turning over the blades at zero incidence. The throttle is open to give a predetermined rotor rpm and the pitch lever is now pulled upward. This action has a twofold effect: the drive mechanism to the rotor is now fully disengaged from the engine and a positive angle of incidence is applied to the rotor blades. The pitch is actually changed as in a variable pitch propeller. With this the rotor bites the air, lifting the craft by means of the kinetic energy stored during the spin. In flight the lever is put into the cruise lock position and the throttle can be trimmed to suit flight conditions.

The Avian gyroplane does not jump vertically upward. It takes off in a fast ascending curve. Nevertheless it needs little clear space and definitely does not need an airport runway.

### More efficient thrust

Its curved ascent path is due in part to the horizontal thrust from the rear mounted propeller. Designed as a ducted fan, it is another big feature which has been used successfully for the first time in practical aeronautics.

The ducting ensures maximum efficiency from the spinning propeller by restricting the flow of air away from the blades at their tip. On any spinning propeller blade the last six inches at the tip perform no function since the air is flowing away. The Avian design puts even the last six inches to work, attaining more thrust from a given propeller diameter. In this case the normal 800-lb. thrust from the 5-ft. 3-in. diameter propeller is boosted to 1,000 lb.

Use of a smaller diameter ducted propeller enables the rotor to be positioned nearer the fuselage datum, improving flight stability and reducing the unit's overall height. The rudder, mounted in the rear section of the duct, is able to take advantage of the increased air flow.

In flight Avian claims a cruising speed of 130 mph over a range of 480 miles. Minimum speed is an amazing 28 mph, a big bonus to both instructor and student in flight training. Both can rest easier knowing there is more time to pull out of trouble if anything goes wrong. Not that it's likely seeing the gyroplane will not go into a spin if it stalls in flight. It's free-spinning rotor provides a drogue action like a parachute.

While keeping costs down has been an important consideration in the Avian design, there has been little sacrifice to the comfort of either pilot or passenger. Mounting the engine in the rear has helped increase the pilot's visibility and reduce cabin noise. A side hinged plexiglass canopy and wide opening door give

generous space for exit and entry.

A stainless steel firewall separates the cabin from the fuel cells (capacity: 26 Imperial gallons) which are mounted above the engine thrust line to give gravity feed to the carburetor. The Lycoming 0-360A, 180 hp engine is installed on a four-point dynafocal cradle mounted to the airframe. The nose of the aircraft houses the instruments, radio and battery and is accessible by means of a hinged alligator hood.

All is supported on a tricycle undercarriage comprising two main solid steel legs and an oleopneumatic fully steerable nose wheel.

### *A western market*

While the gyroplane will be in competition with the helicopter, to a certain extent, its main market is expected to be found in an entirely separate field. The craft can't hover but it can take off almost vertically making it handy for door-to-door flying. Its longer range — 480 miles — is likely to be a big attraction in Canada's north.

Avian looks to the western provinces for its main sales. Perhaps the biggest potential is in oil exploration with good prospects among the country doctors.

Expected selling price is around $15,000. While this is less than half the price of the average helicopter, there are some economical helicopters now available at just over $20,000. However Avian hopes the safety feature and the ease of operation will attract people who would not venture to pilot a helicopter.

A company spokesman put it this way: "Gaining a helicopter license is likely to cost the student about $2,500, while the prospective Avian pilot should be able to get into the air for about $350, and with a lot less trouble." ★

# How well do you know your aluminum?

Here's a challenge to see what you remember of the characteristics of aluminum. It's another in a series to test your memory on some of the most important engineering materials.

The following questions and answers were prepared by Aluminum Company of Canada Limited, 1700 Sun Life Building, Montreal 3, Quebec.

**Question 1**
How does aluminum rate as an electrical conductor?

**Question 2**
Why is aluminum used both for thermal insulation and as a conductor of heat?

**Question 3**
Can aluminum be surface hardened?

**Question 4**
Does aluminum oxidize?

**Question 5**
Does aluminum require greater allowance for thermal expansion than steel?

**Question 6**
Can aluminum replace steel as a structural material?

**Question 7**
What happens to aluminum at low temperatures?

**Question 8**
How is aluminum used by the steel industry?

**Question 9**
Is aluminum difficult to weld?

**Question 10**
Is aluminum easily machinable?

**Question 11**
Can aluminum be flame cut?

**Question 12**
What happens to aluminum at high temperatures?

**Now turn to page 55 to check your answers.**

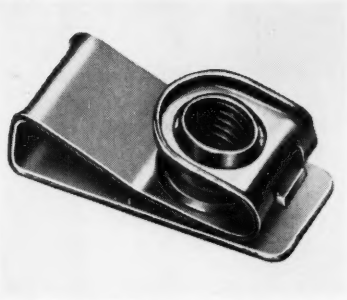
# New products and materials

## Connector socket

A hermetically sealed connector with pin-to-socket compact inserts. Feature is a combination of full compression glass, on the pin side, and a resilient silicone insert on the socket contact side. Both inserts have positive contact identification in perfect correlation to the plug inserts. Extra thickness of the hermetic insert permits operation under extreme pressure loads. **The Deutsch Company**

**Circle 301 on Reader Service Card**

## Clip-on fastener



A self-locking fastener for aircraft applications such as attachment of flooring or fiberglas assemblies providing the .020 inch thickness of the clip can be tolerated between mating surfaces. A locating eyelet formed on the base plate snaps firmly into the hole drilled or punched in the sheet. **Elastic Stop Nut Corp. of America.**

**Circle 302 on Reader Service Card**

## Thermistor motor

An a-c motor protected against overheating by positive temperature coefficient thermistors. The thermistor, a semiconductor device without moving parts, provides a warning when overheating occurs. Thermistors are installed in the motor windings and can take the motor off the line when overheating occurs. **Canadian Westinghouse**

**Circle 303 on Reader Service Card**

## Spiral tubing

A seamless flexible conduit made of Teflon which can be used at temperatures from minus 100 to plus 500F. Present produced in sizes from ½ to 3 inches. **Resistoflex Corporation**

**Circle 304 on Reader Service Card**

## Circuit breaker

A small tubular electrical circuit breaker designed for motor protection in shaded pole or permanent split capacitor motors up to ¼ hp, as well as solenoid, transformer or fluorescent light ballast protection. 1¼ in. long by just over ⅛ in. diameter, the protector can be mounted at the source of heat ensuring rapid accurate temperature response. **Mechanical Products Inc.**

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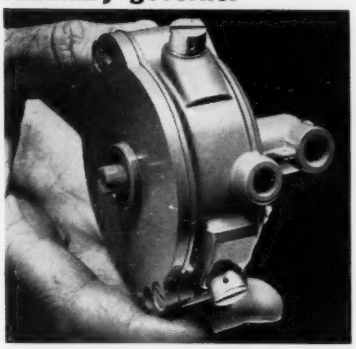
## Auxiliary governor



An auxiliary governor system to control the speed of power equipment with a wide variation in load requirements. It is not limited to hydraulic applications and can be adapted to control the speed of mechanical devices powered by gasoline engines. The system operates from a driven unit mounted on the power take-off and automatically adjusts the throttle to maintain specified speed of the work tool with every change in load. **Holoey Carburetor Company.**

**Circle 306 on Reader Service Card**

## Re-rate induction motors

The first motors in Canada to expand the re-rate design above the currently recognized CEMA 445U frame range. Compact design will provide continuity in appearance, size and performance. **Canadian Westinghouse**

**Circle 307 on Reader Service Card**

## Tube fitting

Fitting with a brass body and knurled nut for finger tight assembly with polyethylene tubing for vacuum or pressure applications. Leak-proof seal is provided for all wall thicknesses without inserts. **Crawford Fittings Canada Ltd.**

**Circle 308 on Reader Service Card**

## Base mounts

Sub-miniature metallized ceramic bases for mounting transistors. A high alumina ceramic wafer or washer in the order of .01 in. thick is metallized using the moly-manganese process. Conductive patterns are then nickel or gold plated to allow lead attachment as well as direct mounting of the silicone dice to the ceramic. **Advanced Vacuum Product Inc.**

**Circle 309 on Reader Service Card**

## Timing motor

An a-c timing motor which has no slippage, stops without coasting and is instantaneously reversible without recourse to mechanical no-back devices. Delivers 30 ounce-inches of torque in either direction at 1 rpm. **Philips Electronics Industries Ltd.**

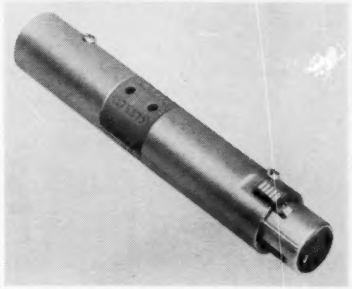
**Circle 310 on Reader Service Card**

## Hydraulic cylinders

A new line being made in Canada with operating pressures up to 5000 psi, and bores up to 14 inches. Many dimensionally interchangeable. **Fluid Power Ltd.**

**Circle 311 on Reader Service Card**

## Galvanometer protector



A unit to prevent coil burnout of magnetically damp galvanometors. It utilizes a replaceable insert which permits repeated use of the protector and can be easily attached to existing galvanometor imput panels with no change in damping resistor networks. **Consolidated Electrodynamics Corp.**

**Circle 312 on Reader Service Card**

## Oil filters

A new series with capacities up to 300 gpm. They are designed for two-stage filtration to trap and retain foreign particles over 8 to 10 microns in size. Contaminants are filtered out before the oil passes through the impregnated second layer for fine straining. **Vickers-Sperry of Canada Ltd.**

**Circle 313 on Reader Service Card**

## Slip rings

A new line of slip rings specifically designed for space applications. Available with up to several hundred circuits, they are characterized by low noise to signal ratios enabling transmission of

*(Continued on page 57)*

# TECHNICAL LITERATURE FILE

Here's an up-to-date listing of some of the technical catalogs and literature available free for the asking. Simply enter the key number shown in **heavy type** at the end of each item on the Reader Service Card which you will find at the back of this issue. There is no postage to pay . . . we will notify the company of your request and the information should reach you within a few days.

## GENERAL ENGINEERING

**Drafting supplies**—General catalogue of drawing room supplies and equipment. Carsen Instruments Ltd. **401**

**Welding symbols** — Designers' guide 1100.1 to proper welding symbols for simplifying drafting. Lincoln Electric Co. of Canada Ltd. **402**

**Reproduction materials** — Bulletin F2-127. Description of materials for photo-reproductions of engineering drawings, maps and documents. Canadian Kodak Co. Ltd. **403**

**Heating and cooling**—Bulletin 103 describing fans, blowers, heaters and refrigerators. Canadian Armature Works Inc. **404**

**Sound control** — Description of air silencers and filters. Bulletin 609. Allied Witan Co. **405**

**Ladders** — Bulletin 159 illustrating side rail design for ladder sections. Chesley-Sarnes Ltd. **406**

**Containers** — Booklet explaining construction principles and describing shipping containers, crates and pallet bins for industrial use. Bathurst Containers Ltd. **407**

**Heat treating**—Condensed catalogue 250 of heat treating, melting, induction and laboratory pilot plant equipment. Lindberg Engineering Co. **408**

**Drafting ideas** — Catalogue with 763 items including tapes, templates, symbols, spaced lettering, planning boards and chart accessories. Chart-Pak Inc. **409**

**Process control** — Bulletin 520-1397 on 1710 control system. International Business Machines Co. Ltd. **410**

**Drawing reproduction** — Bulletin X326 explaining 1824 printer for reproducing engineering drawings. Xerox of Canada Ltd. **411**

**Nameplate selector**—Catalogue 777 on self-bonding nameplates with information on design, artwork, mil specs. W. H. Brady Co. of Canada Ltd. **412**

**Spray equipment**—General catalogue W-59 on air compressors, paint spray equipment and spray booths. Webster Air Equipment Ltd. **413**

**Roll grinders** — Illustrated bulletin 122 covering a line of newly designed roll grinders for steel mills. Farrel-Birmingham Co. **414**

**Paperwork copying**—Bulletin A-2785 on new equipment for diazo-type white or color-tinted copies. Charles Bruning Co. (Canada) Ltd. **415**

**Fire hose cabinets** — Bulletin WC.1S showing a complete series with adjustable trim features. Wilson & Cousins Co. Ltd. **416**

**Designer's viewer** — Bulletin describing viewer with chain and sprocket drive for visualizing, scaling, lettering and cutting stencils. M. P. Goodkin Co. **417**

**Marking Machines** — Pocket catalogue indexing numerous marking machines, both manual and automatic. The Acromark Co. **418**

**Dust collectors** — Bulletin 736-1 detailing 50 models of dust collectors and 4 mist collectors. Aget Mfg. Co. **419**

**Spray cleaning** — Bulletin 467 covering a process for cleaning precision components. Cobehn Inc. **420**


**DRAFTING** —Catalogue of Alpha, Faber-Castell, etc. drawing room supplies and equipment. **178**

**TRACING PAPER** —Sample folder on Alpha Vellum, Bond and Sketch. **185**

**SURVEYING** —Catalogue of THS Transits, Levels, etc. **179**

**SURVEYING** —Brochures on Fennel Transits, Levels and Theodolites. **180**

**MEASURING TAPE** —Brochure on ESLON fibre glass tapes. **181**

**MEASURING TAPE** —Brochure on ALPHA-METRI measuring tapes. **182**

**ADVERTISING SPECIALTIES** —Catalogue showing gifts and specialties especially suited to the Engineering trade. **183**

**THERMOCHROM**—Brochure on Castell temperature measuring crayons. **184**

**CARSEN INSTRUMENTS LTD.**
**162 Bentworth Ave., Toronto 19, Ont.**


## MECHANICAL COMPONENTS

**Rotary air products**—Catalogue 660 of motors, compressors and vacuum pumps, including oil-less models. Gast Mfg. Corp. **501**

**Clutches**—Literature SF8 on centrifugal, gear tooth and pin drive clutches. Mercury Clutch. **502**

**Vibration control**—Product guide 905 to mountings, joints, panels, couplings and suspension systems. Lord Manufacturing Co. **503**

**Hydraulic components**—Bulletin 5001-C describing fluid power pumps, controls and actuators for industrial and marine service. Vickers-Sperry of Canada Ltd. **504**

**Gear motors**—Bulletin G839AM listing ratings available, with dimensions and technical data. Munck Ltd. **505**

**Materials handling** — Bulletin C501 on power and gravity conveyor systems. Sadler Conveyor & Equipment Ltd. **506**

**Steam generators**—Bulletin SG602 with specifications of packaged steam generators. John Inglis Co. Ltd. **507**

**Steel fabrication** — Brochure illustrating company's scope and facilities. Dominion Bridge Co. Ltd. **508**

**Press brakes**—Bulletin describing tools and dies suitable for press brakes. Bradley Machine Co. Ltd. **509**

**Centrifugal crusher**—Bulletin DC-61 describing newly designed crusher for reducing material by centrifugal action. Simplicity Materials Handling Ltd. **510**

**Gas combustion**—Paper on natural gas industrial burners. Wayne Forge & Machine Tool Co. Ltd. **511**

**Couplings and drives** — Catalogue 460 describing performance and application of free space hydraulic units. Also comprehensive selection tables. Crofts Canada Ltd. **512**

**V-belt drive**—Design catalogue DH-901 on a new V-belt drive. Gates Rubber of Canada Ltd. **513**

# Technical literature file

*continued*

**Ventilating units** — General descriptive bulletin 1261 on a new heating, cooling and ventilating unit. Sarco Canada Ltd. **514**

**Steam boilers** — Bulletin 1/59 outlining capabilities of steam generator with fully automatic controls. Modenco of Canada Ltd. **515**

**Industrial equipment**—General catalogue P-192 covering pumps, valves, soot blowers, compressors, instruments, mining equipment. Peacock Bros. Ltd. **516**

**Blowers, boosters, pumps** — Descriptive catalogue 725 giving operating capacities. Godfrey Engineering Co. Ltd. **517**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| Cylinders Air and Hydraulic | **168** |
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| Hydro-Checks* | **174** |
| Accessories | **175** |
| Spot-A-Mation application file | **176** |

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**BELLOWS-VALVAIR LTD.**

**14 Advance Rd., Toronto 18, Ont.**


**Bronze pumps**—Condensed bulletin 1-6B covering a complete range of bronze gear and centrifugal pumps. Albany Pump Co. Ltd. **518**

**Air equipment**—Detailed technical bulletin 100 on design features and operational data of rotary air compressors. Bullows Air Equipment. **519**

**Air conditioning** — Bulletin TP-155A listing air cooled condensing units and cooling coil assemblies for 2, 3, 4, 5 and 7½ ton capacities. The Canadian Coleman Co. Ltd. **520**

**Triodetic structures** — Technical outline of a structural connection system which eliminates welding, bolting and rivetting. F. Fentiman & Sons Ltd. **521**

**Roller chains**—Catalogue 205 of chain and sprockets. Cullman Wheel Co. **522**

To secure the literature listed, simply enter the number shown in **heavy type** at the end of the item, on the Reader Service Card at the back of the book . . . then mail to Design Engineering.

**Angle gear reducers**—Bulletin 117 on a complete line of right angle gear reduction units. Hamilton Gear and Machine Co. **523**

**Safety slings**—Bulletin S157 describing slings with a special rubber sleeve arrangement to minimize slipping. Donald Ropes & Wire Cloth Ltd. **524**

**Materials handling** — Brochure covering bins and batchers, stationary and portable plants, silos, elevators and conveyors. The Waterloo Mfg. Co. Ltd. **525**

**Aircraft couplings** — General description of a line of aircraft and missile couplings from stock or designed for special needs. On Mark Couplings Inc. **526**

**Centrifugal clutches**—Bulletin 550-1960 with information on a line of clutches. BLM Automatic Clutch Corp. of Canada Ltd. **527**

**Cylinders and valves**—Catalogue covering pneumatic cylinders and control valves. John Spotton Co. Ltd. **528**

**Leather packings** — Bulletin describing leather packings in nested V, cup, flange and "U" types. Also leather washers, gaskets and diaphragms. Hamilton Leather Belting Co. Ltd. **529**

**Chain fittings**—Folder HS160 illustrating chain and wire rope fittings. Canadian Warren Pink Ltd. **530**

**Motors** — Bulletin DMC-261 outlining various models of gasoline, diesel, gas and oil fuel engines. Continental Motors of Canada Ltd. **531**


**EYELETS** Catalogue of low cost fasteners for electronics, plastics, toys, garments, also necessary machines for automatic feeding and setting. **220**

**UNITED SHOE MACHINERY CO. OF CANADA LIMITED**
**P.O. Box 1658, Place d'Armes, Montreal, Que.**


**Fluid power**—Booklet 0090-B1 offering a pictorial index of the company's industrial pneumatic and hydraulic components. Parker-Hannifin Corp. **532**

**Power transmission**—Catalogue 760 listing roller chains, sprockets and couplings. Diamond Chain Co. Inc. **533**

**Filter panel**—Bulletin 372-101 describing a permanent, washable air filter panel for ventilating electronic equipment cabinets. Air-maze Div., Rockwell-Standard Corp. **534**

**Quick-connect coupling**—Catalogue 60A on a coupling, with complete information on flows, pressure rating, pressure drops and dimension. Snap-Tite Inc. **535**

**Pumps and motors**—Folder of hydraulic piston pumps and motors. Lucas-Rotax Ltd. **536**

**Valves**—Bulletin 654C listing a complete line of valves for hydraulic, water, gas, air and chemical service. Richardson Equipment Co. Ltd. **537**

**Cylinders**—Bulletin 801 giving engineering data on air and hydraulic cylinders. Hanna Engineering Works **538**

**Transmission equipment**—Bulletin 6 describing shaft-mounted reducers, V-belt drives, conveyor pulleys and bases. Montreal Gear Works Ltd. **539**

**Industrial pumps** — Bulletin 100 giving complete application data on a full line of pumps. The Robbins & Myers Co. of Canada Ltd. **540**

**Production parts** — Design engineers' manual 921 presenting a comprehensive listing of the most commonly used standard production parts. Lincoln Engineering Co. **541**

**Feed pumps and tanks** — Bulletin 1 covering chemical feed pumps and tanks for boiler and air conditioning water treatment. Van Camp Products and Sales Ltd. **542**

**Fluid power cylinders** — Bulletin 60/20 describing cylinders with bores from 2 to 14 in. Cowan Dynamics Ltd. **543**

**Plastic pipes** — Engineering handbook CV9 covering corrosion-free drainage pipes and fittings. Beardmore & Co. Ltd. **544**

**Valves**—General catalogue 57 outlining bronze, iron, cast steel and special alloy valves in pressures up to 500 psi. Canada Iron Foundries Ltd. **545**

**Water softeners**—Bulletin ECS-61 covering a new line of packaged commercial water softeners. Pumps & Softeners Ltd. **546**

**Industrial burners**—Engineers' handbook with data on commercial and industrial conversion burners and packaged boilers. Canadian Brown Steel Tank Co. Ltd. **547**

**Conveyor chains**—Bulletin 6158 giving design and selection data on light duty conveyors. Rex Chainbelt (Canada) Ltd. **548**

# Technical literature file

*continued*

**Cast bronze parts**—Bulletin JBL-36 comparing bearing bronze parts made by special process with those made by sand casting. Johnson Bronze Co. **549**

**Knobs and handles**—Catalogue of standard items including ball and oval knobs, tapered handles, knurled handwheels, thumbscrews and instrument knobs. Dimco-Gray Co. **550**

**Oil seals**—Catalogue 61-B of sizes and technical data for a line of oil seals. National Seal Div., Federal Mogul Bower Bearings Inc. **551**

**Air hose**—Industrial catalogue 205 covering air hose and fittings. Aeroquip (Canada) Ltd. **552**

**Fluid power parts**—General line bulletin FP-60 describing components. Bellows-Valvair Ltd. **553**

**Fire extinguishers**—Bulletin I-19c covering engineered carbon dioxide fire extinguishing systems, both automatic and manual for special hazards. Walter Kidde & Co. of Canada Ltd. **554**

**Speed reducers**—Bulletin 201-61 guiding selection of straight line speed reducers. David Brown-Foote Gears Ltd. **555**

**Bearings** — Catalogue S-60 listing 1066 standard bearing sizes. Perth Metal Industries Ltd. **556**

**Roller chain**—Bulletin 2657 with tables for selection and design of roller chain drives. Link-Belt Ltd. **557**

**Electrohydraulic pumps**—Bulletin 47740 describing three new lines of variable delivery, heavy duty, servo controlled pumps and electric control system components. The Oilgear Co. **558**

**Steam traps** — Brochure 900A on new floating disc units. The Clark Mfg. Co. **559**

**O-rings and packings**—Engineering handbook presenting data for solving all sealing problems. Precision Rubber Products (Canada) Ltd. **560**

**Valves and cylinders**—Bulletin SW-3 describing a complete line of air and hydraulic models. Galland-Henning Nopak Div. **561**

**Mixing equipment**—Bulletin 591 covering a range of industrial mixers. Conn & Co. **562**

**Level gauges** — Catalogue presenting illustrative engineering information on 168 styles and sizes of direct reading liquid level gauges. Gits Bros. Mfg. Co. **563**

**Hydraulic presses**—Bulletin 16 describing a line of laboratory and production presses (12 to 100 ton) for applications involving temperature and pressure. Wabash Metal Products Inc. **564**

**Electronic processing equipment** — Bulletin 901 describing pressing, compacting and molding equipment and vacuum technology. E. J. Stokes Co. of Canada Ltd. **565**

**Air cylinders**—Catalogue 115A of 200 psi square type air cylinders. Ortman-Miller Machine Co. Inc. **566**

**Molded bearings**—Bulletin 100 illustrating applications for molded fabric bearings. Gatke Corp. **567**

**Displacement pumps**—General reference catalogue 100 covering standard and modified pumps for lubrication, fuel oil, hydraulic and transfer service. Tuthill Pump Co. **568**

**Vibration inducers**—Data form 1044 describing inducers to move materials out of hoppers, down chutes and through screens. Martin Engineering Co. **569**


**HYDRAULIC CYLINDERS AND ACCUMULATORS** **203**

Bulletin 59-68—details of 2000 psi (3000 psi non-shock) hydraulic cylinders.
C.A.I. series piston accumulators outlined.
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**Roller bearings**—Handbook H-62 detailing needle type and heavy duty gauge type bearings and cam followers. McGill Mfg. Co. Inc. **570**

**Drives and couplings**—Bulletin AP-160 describing a complete line of variable speed belt drives and flexible couplings. Gerbing Mfg. Corp. **571**

**Hydraulic pumps**—Catalogue PHD describing hydraulic pumps, control valves and power packages. Owatonna Tool Co. **572**

**Water valves** — General catalogue 60 covering fire hydrants, gate valves, butterfly valves and special models. The Canada Valve and Hydrant Co. Ltd. **573**

**Cylinders and valves**—Catalogue 1000 of hydraulic cylinders and valves with specification data. Dukes Co. Inc. **574**

**Bearing units**—Bulletin 454 describing a line of ball bearing units. Stephens-Adamson Mfg. Co. of Canada Ltd. **575**

**Plastic tank**—Bulletin describing the design of a reinforced plastic tank with an outline of important advantages. Markham Reinforced Plastics Ltd. **576**

**Centrifugal blowers**—Bulletin ACB-220 describing new compact cast aluminum blowers and exhausters. Hoffman Industries of Canada Ltd. **577**


A complete product catalog of Fluid Power components, including pumps, valves, controls and cylinders. Please write on your letterhead to: **186**
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**Control valves** — Bulletin LB-4 describing a series of split-body control valves with optional actuators and accessories. Conoflow Corp. **578**

**Fluid power** — Catalogue covering hydraulic and pneumatic cylinders, valves and drill units. Alkon Products. **579**

**Spring design** — Series of data sheets with design procedure on constant force springs. Hunter Spring Co. **580**

**Gerotors** — Bulletin G-1 describing a series of gerotors for integral and special lube, scavenge, oil and low pressure hydraulic pumps. W. H. Nichols Co. **581**

**Flexible shaft** — Bulletin 570 with complete design data on flexible shafting, including units with built-in bearings and couplings. Stow Mfg. Co. **582**

**Gear-type couplings** — Catalogue 2400 M97 on a line of gear-type couplings. Koppers Co. Inc. **583**

**Rotary actuators** — Catalogue HYD-1 showing characteristics and envelope drawings of a line of actuators. Houdaille Industries Inc. **584**

**Peristalic action pumps** — Bulletin SM 50-A REV giving general and technical information. Sigmotor Inc. **585**

**Fluid power equipment** — Guide 10-001 to a line of pumps, motors and control valves. The New York Air Brake Co. **586**

**Tank units** — Bulletin 61-B describing a general purpose unit for supplying

# Technical literature file

*continued*

coolant to machine tools. The Ruthman Machinery Co. **587**

**Hose fittings** — Condensed catalogue 34 describing majot items of fittings for industrial rubber hose. Hose Accessories Co. **588**

**Universal joints** — Catalogue C5 of industrial universal joints, with hints for the design engineer. Curtis Universal Joint Co. **589**

**Hydraulic couplers**—Complete catalogue 5902 of a line of couplers and accessories. Pioneer Hydraulics Inc. **590**

**Screw conveyors** — Catalogue 160 of a complete line of helicoid conveyors. Strong-Scott Ltd. **591**

**Spring pivots** — Bulletin EET-144 describing the design of flat flexure spring pivots. Humphrey Inc. **592**

**Flexible tubing** — Bulletin 10-19 covering non-metallic tube for handling air, liquids and light solids. Affiliated Engineering Equipment Ltd. **593**

**Airborne seals** — Bulletin 5800 describing rubber and rubber-metal seals for high temperature applications. Parker Seal Co. **594**

**Precision balls** — Description of balls of tungsten, carbide, ceramic, sapphire, nylon, teflon, high speed steel and other materials. Industrial Tectonics Inc. **595**

**Ball bearings** — Bulletin 110 giving dimensional data and load ratings for single row deep groove bearings of open, shielded, teflon sealed, felt sealed and cartridge types. Hoover Ball & Bearing Co. **596**

**Tube fittings** — Bulletin 8-60 describing a line of tube fittings. Crawford Fittings (Canada) Ltd. **597**

**Solenoids** — Bulletin describing operating and construction features of solenoid operated air valves. Mechanical Air Controls Inc. **598**

**Fluid power equipment** — Brochure AH-80-1 briefly describing air and hydraulic cylinders and air valves. The Wellman Engineering Co. **599**

**Stainless steel bearings** — Form 1551-1 describing materials used for rings, balls and cages. Shields and seals are also included. Marlin-Rockwell Corp. **850**

**Heat exchangers** — Bulletin 1845 covering shell and heat transfer equipment. S. A. Armstrong Ltd. **851**

**Variable speed drives** — Bulletin 700 on a line of lubrication-free units. Sterling Electric Motors Inc. **852**

**Miniature bearings** — Bulletin with dimensional tabulations and data on 65 bearings in the miniature and instrument range. New Hampshire Ball Bearings Inc. **853**

**Flexible hose**—Brochure TF 11-61 describing metal and teflon hose, quick disconnect couplings. Titeflex Inc. **854**

**Precision bearings**—Condensed catalogue C-4 listing standard and special design products. The Barden Corp. **855**

## ELECTRICAL COMPONENTS

**Crossbar switches** — Bulletin 60-115. Complete discussion of crossbar switches with illustrations, charts and performance data. James Cunningham, Son & Co. **601**

**Terminals** — Bulletin on glass-to-steel hermetic terminals. Fusite Corp. **602**

**Cable clamps**—Bulletin 802 with property tables, dimensions and test data on stock types. Weckesser Co. Inc. **603**

**Relays and solenoids**—Data DS-1-1060 on a product line for micro-miniature, telephone and general purpose applications. Phillips Control Co. **604**

**Cable clamps**—Folder PCB-1161 illustrating clamps and straps made of ethyl cellulose, polypropylene, nylon and saran. Holub Industries Inc. **605**

**Wires and cables** — Listing PW-61 of CSA approved power cables, flexible cords and fixture, appliance and hook-up wires. Canada Wire and Cable Co. Ltd. **606**

**Heating units**—Catalogue 50 of special and standard lines with data on heat losses. The Canadian Chromalox Co. Ltd. **607**

**Transformers** — Bulletin D5001-1. Construction information and dimensions for dry-type power transformers. Moloney Electric Co. of Canada Ltd. **608**

**Relays and solenoids**—Updated catalogue 121 on a full range of items. Osborne Electric Co. Ltd. **609**

**Oil heating** — Bulletin 75 covering installation, system design and operation of resistance heating for bunker fuel oil supply pipes. Powertronic Equipment Ltd. **610**

**Magnetic shift registers**—Bulletin 59-1A. Description and theory along with listing of standard types. C&K Components Inc. **611**

**Ceramic capacitors**—Literature 503-1 on tubular and disc types with capacitance from 1.5 pf to .05 mf, with working voltage to 6 KV. Erie Resistor Corp. **612**

**Switches**—Catalogue of open and closed snap action switches. Cherry Electrical Products Corp. **613**

**Transistors**—Reference chart of a line of transistors. Philco Corp. of Canada Ltd. **614**

**Heating equipment**—Bulletin RC1 listing electric process heaters. P. M. Wright Electrical Co. **615**

**Electro-magnetic relays**—Catalogue C-60 detailing wide range with contact loads, speeds, mountings, enclosures, shock and vibration characteristics. Potter & Brumfield. **616**

**General components**—Catalogue of contactors, switches, relays and pilot devices. Klockner-Moeller Canada Ltd. **617**

**Limit switches** — Bulletin EC-SL-61 covering new types of switches with butt and sliding contacts, and describing current ratings and variety of operating sequences. Acme Machine Tool. **618**

**Insulating varnish** — List SV116 of chemical and electrical characteristics of a special insulating varnish. Schenectady Varnish Canada Ltd. **619**

**Distribution equipment** — General catalogue with descriptive sheets on all equipment. Federal Pacific Electric of Canada. **620**

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# Technical literature file

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**Electronic components**—Bulletin IEC-4. Cross-section of cables, connectors and tube sockets. Amphenol Canada Ltd. **621**

**Barrier terminal strips**—Bulletin describing standard types taking up to eight conductors. United-Carr Fastener Co. of Canada. **622**

**Wiring components** — Bulletin WC-1 covering duct, plastic wiring cable clamps and ties, and spiral wrapping cable sheath. Panduit Corp. **623**

**Distribution cutouts**—Bulletin 104. Description of a line of open end type units. Dominion Cutout Co. Ltd. **624**

**Electrical components**—Summarized description of products and services including electrical contacts, resistance welding supplies, silver brazing alloys, electrolytic capacitors, timer switches, precious metals. Johnson Matthey & Mallory Ltd. **625**

**Electronic systems**—Bulletin 516 covering high speed systems, sub-systems and component. Ferranti-Packard Electric Ltd. **626**

**Meters and transformers** — Literature M-71 on full range of panel and portable meters and current transformers. Canadian Research Institute. **627**

**Contacts** — Short form catalogue C601 with materials, specifications and recommended primary applications. Gibson Electric Sales Corp. **628**

**Electric components** — Bulletin M/103 ED1. Summary of range of components and specific technical brochures. Standard Telephones & Cables Mfg. Co. Ltd. **629**

**Terminal blocks** — Details of sectional terminal blocks, wire connectors and conduit fittings. Bulletin G101. ESNA Canada Ltd. **630**

**Switches and relays**—Catalogue 100 of product line. Arco Div., Robertshaw-Fulton Controls Co. **631**

**Stock motors**—List S2-A of 325 reducer and non-reducer stock fractional horsepower motors. Bodine Electric Co. **632**

**Electric motors**—Brochure P-86012 describing a complete line of mass-produced motors. Franklin Electric Co. Inc. **633**

**Terminal blocks**—Bulletin K2-5 covering disconnect terminal blocks or strips for high density wiring on audio, control, video and pulse circuits. Thomas & Betts Ltd. **634**

**Contact relays** — Literature on mercury plunger type and mercury wetted contact relays. The Adams & Westlake Co. **635**

**Printed circuit connectors** — Bulletin PB-KZ describing connectors with new type of contact. Winchester Electronics Inc. **636**

**Diodes and rectifiers** — Specification and price schedules on germanium and silicon diodes and rectifiers. Semi-Elements Inc. **637**


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**Delay lines** — Bulletin 100 DL guiding selection of delay lines. Shallcross Mfg. Co. **638**

**Electrical wiring** — Brochure covering rubber over-the-floor electrical wiring systems, raceway and fittings. Ideas Inc. **639**

**Line and cable** — Catalogue 60 of pole line hardware. Line & Cable Accessories Ltd. **640**

**Generator sets** — Listing 85A68 of generator sets for off the line power. General Motors Diesel Ltd. **641**

**Connectors and terminals** — Bulletin G101 covering solderless connectors for wiring splicing and terminating, and sectional and one piece terminal blocks. Buchanan Electrical Products Corp. **642**

**Electronic components** — Complete catalog S600 of a full line of electrical and electronic components. Cambridge Thermionic Corp. **643**

**Adjustable speed drives** — Bulletin 2900 outlining models in the ¾ to 2500 hp drive range. Louis Allis Co. **644**

**Electric motors** — Bulletin 7a Ba describing a line of geared, non-geared and synchronous motors for vending machines, appliances, displays and toys. Barber-Colman Co. **645**

## MATERIALS

**Mica insulation** — Bulletin E-MICO1-2 (101) covering mica paper products for rigid and flexible electrical insulation. Mica Insulating Div., 3M Co. **701**

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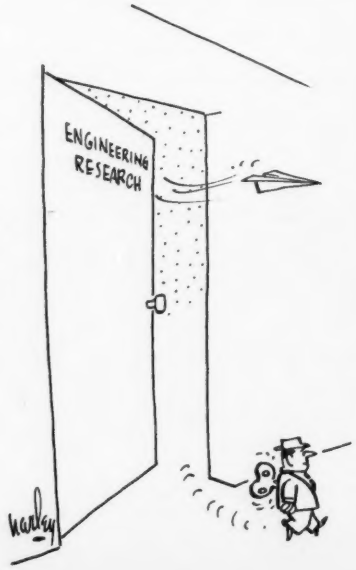


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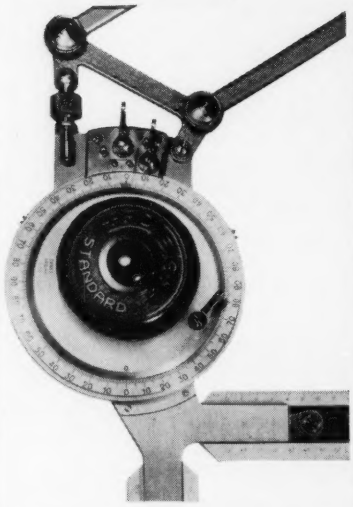


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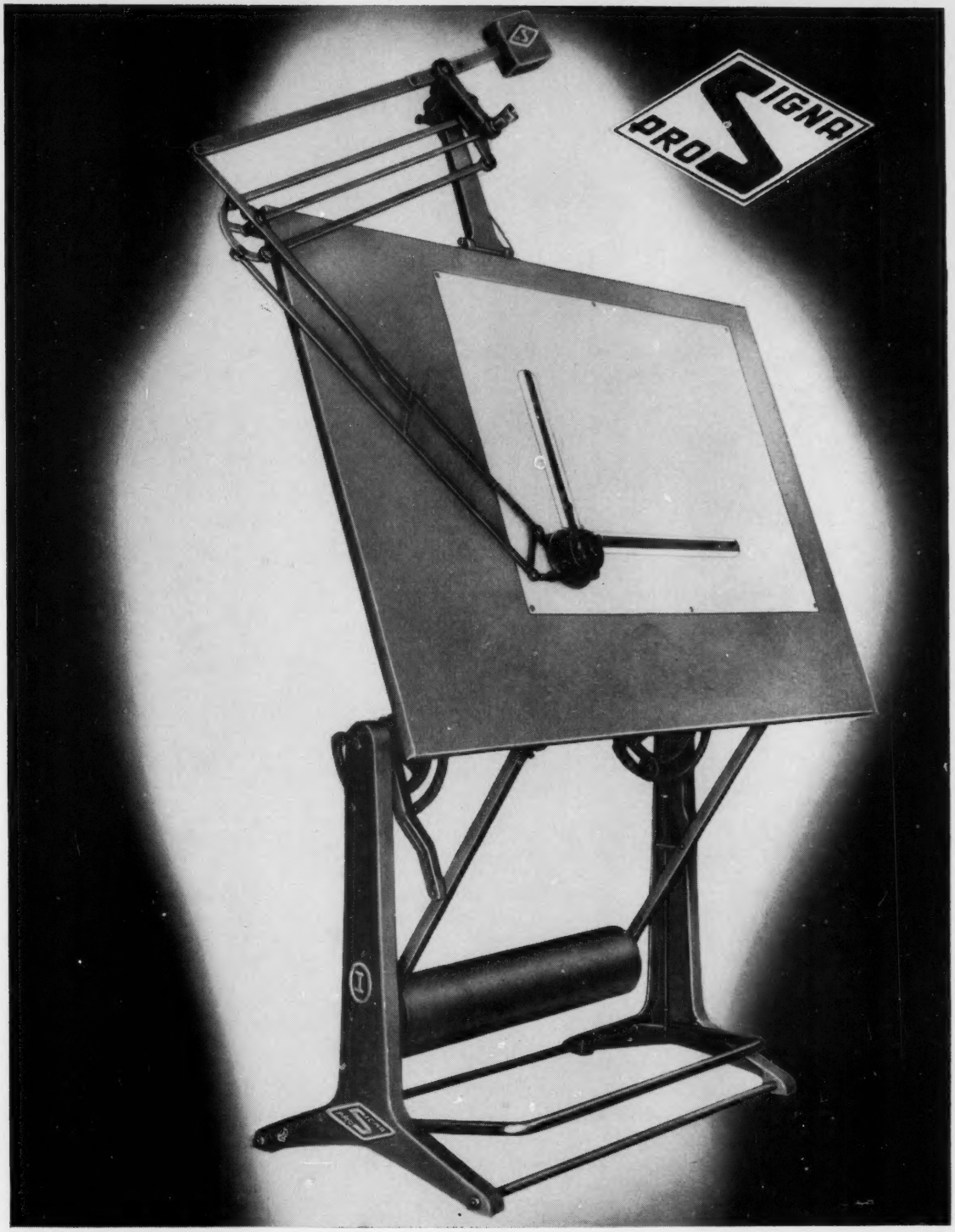


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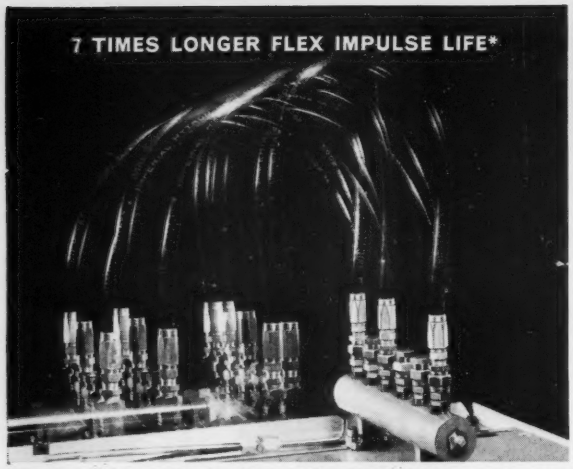


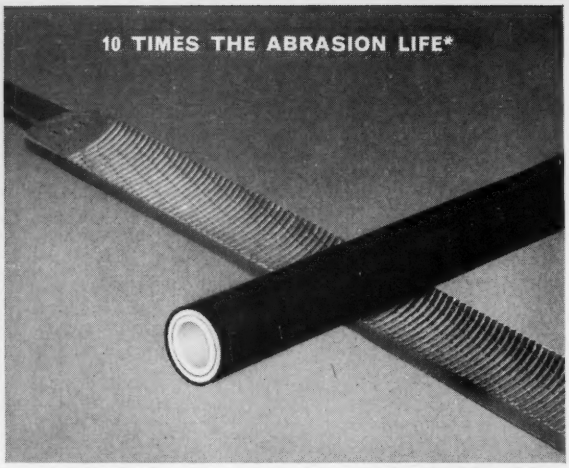


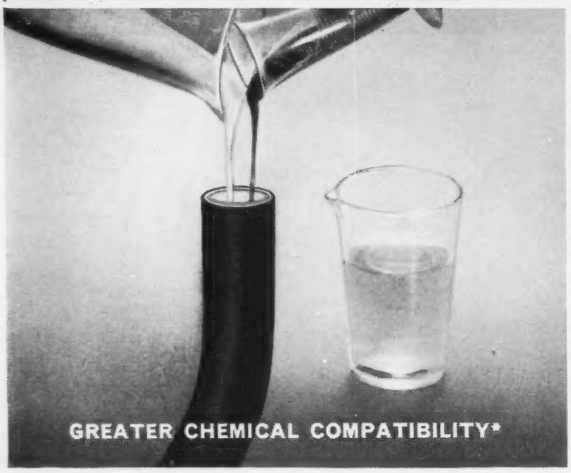


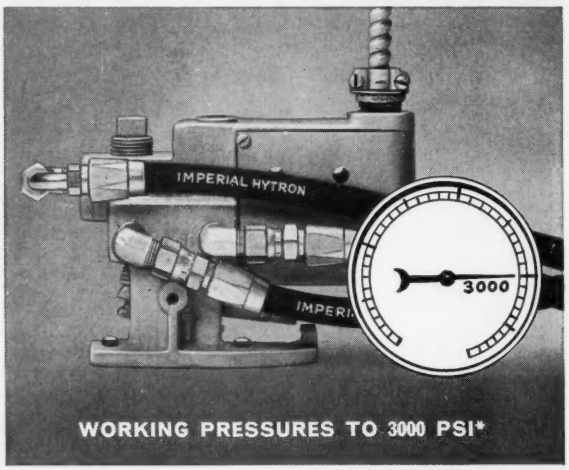


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**Question 2:** Why is aluminum used both for thermal insulation and as a conductor of heat?
**Answer:** Up to 95% of radiant heat is reflected from the bright surface of aluminum which has been polished by cold rolling. The metal is therefore an efficient insulator against radiant heat. However, the capacity of aluminum to conduct heat is very good: about 2/3 that of copper, twice that of zinc, 5 times that of mild steel and 10 times chinery in preference to steel.

**Question 3:** Can aluminum be surface hardened?
**Answer:** Yes, by anodizing. A special process, hard anodizing, can give aluminum a surface (Diamond Pyramid Hardness number of 500) which is harder than the surface of nitrided steel.

**Question 4:** Does aluminum oxidize?
**Answer:** Yes. Aluminum, like other metals oxidizes when exposed to the atmosphere. The oxide is colorless, transparent, chemically inert and adheres strongly to the surface of the metal.

**Question 5:** Does aluminum require greater allowance for thermal expansion than steel?
**Answer:** No. The coefficient of thermal expansion of aluminum is twice that of steel. However, its low modulus of elasticity reduces thermal stresses and its good thermal conductivity reduce temperature gradients.

**Question 6:** Can aluminum replace steel as a structural material?
**Answer:** Yes. Structural alloys of aluminum have yield strength comparable with mild steel. Owing to the greater elasticity of aluminum, it is necessary to increase section moduli to obtain the rigidity and/or bending strength of a steel beam. Comparable structural characteristics can be achieved with aluminum allowing weight reductions of between ½ and 2/3.

**Question 7:** What happens to aluminum at low temperatures?
**Answer:** Aluminum gains slightly in strength and ductility as the temperature drops. For this reason aluminum is used in tonnage oxygen plants and other cryogenic equipment. In very cold climates, aluminum is used in structures and machinery in preference to steel

**Question 8:** How is aluminum used by the steel industry?
**Answer:** Aluminum is added to certain types of molten steel for dioxidizing the melt. Aluminum is also an alloying constituent for magnetic steels.

**Question 9:** Is aluminum difficult to weld?
**Answer:** No. Aluminum can be welded more easily and faster than steel with new gas-shielded metal arc systems. Owing to high weld speeds and good heat conductivity, distortion and residual stresses are low. Stress relieving is unnecessary.

**Question 10:** Is aluminum easily machineable?
**Answer:** Yes. The harder aluminum alloys are readily machineable. Special free machining alloys which contain small quantities of lead and bismuth are suitable for screw machine products made on high speed automatic machinery. Pure aluminum is soft, ductile and difficult to machine.

**Question 11:** Can aluminum be flame cut?
**Answer:** No. However, aluminum can be cut more easily and more rapidly than steel with ordinary machine shop techniques (making allowance for wider spacing of cutting teeth). It can also be cut by the inert gas shielded arc method.

**Question 12:** What happens to aluminum at high temperatures?
**Answer:** All aluminum alloys lose strength rapidly at temperatures above 200 deg. C. The melting point of pure aluminum is 660 deg. C. Aluminum alloys begin to melt at temperatures down to 475 deg. C. Sintered aluminum powder, with an oxide content as high as 15%, can withstand continual heat of up to 550 deg. C., showing no loss of properties when returned to room temperature.

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# New products

*(Continued)*

minute signals without distortion. They are designed to withstand tremendous shocks. **Slip Ring Co. of America**

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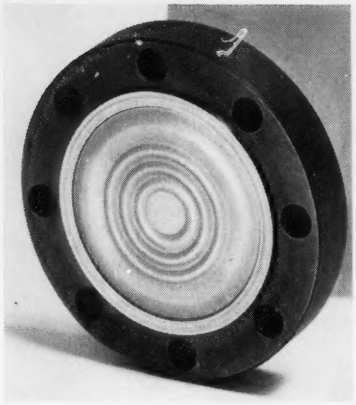
### Diaphragm seals



A newly developed diaphragm seal on which the diaphragm has been welded. It is claimed that, apart from eliminating leakage, the seal has a life in excess of two million cycles and is 20% smaller than earlier comparable units. **Brian Engineering Ltd.**

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### Silicone foam

A new silicone rubber foam claimed to have low weight and extreme temperature stability. It is flexible, compressible and has complete return memory. A low die electric constant and exceptionally low dissipation factor make it suitable for microwave lens and absorbers. **Emerson & Cuming Inc.**

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### Limit switch

A low cost precision snap-action switch capable of underwater operation without leakage. It is engineered for a minimum life capacity of 1,000,000 cycles and has been actuated 200,000 times with full overtravel under one inch head of water without leaking. **Controls Co. of Canada Ltd.**

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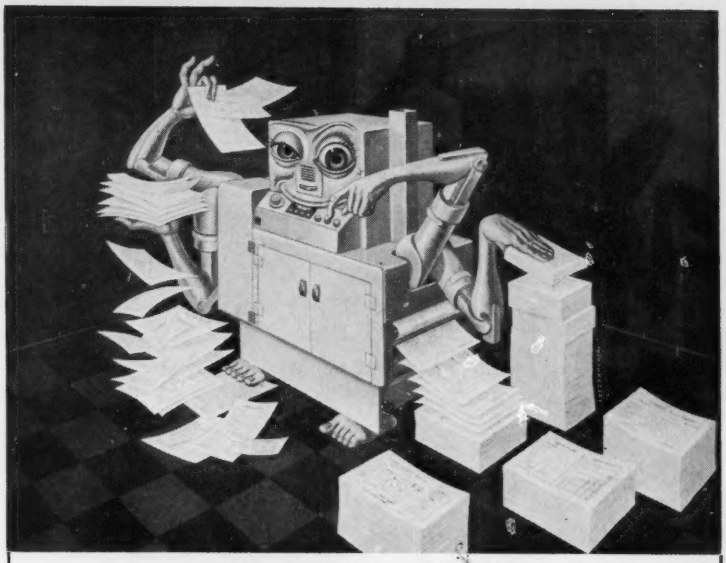
### Core and coils

Core and coils designed for use in equipment enclosures such as distribution power centres where individual protective cases are not necessary. The HV and LV are located at the top of the units. Bus bars can be connected directly to the terminals. **Canadian Westinghouse Co. Ltd.**

**Circle 318 on Reader Service Card**

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## 1961 outlook improves further for original equipment industries

Factory shipments for Canada's original equipment industries are expected to be worth $8.1 billion for the year ending December 31, 1961. This is only 1% down on last year's figures.

The estimates were made by Design Engineering's research department in its latest survey. The outlook has improved since DE made its last forecast in the October issue, mainly because of a healthier outlook in the automobile industry.

These surveys are the first ever made of Canada's original equipment industries.

The iron and steel products group should exceed 1960 levels by 1% aided by a sizeable boost of 23% in office, household and store machinery. But wire and wire goods are expected to slump 9%.

DE's research department says primary iron and steel's position is now much stronger following the slump during the first few months of 1961. It has predicted record production for the rest of this year, at least.

Other features of the forecast are:

- 6% decline in the transportation equipment group, with a loss of 26% in railway rolling stock. Auto shipments should almost equal last year in numbers, but shipment value will be down about 3% because of a larger proportion of compacts.
- 5% loss in the electrical apparatus and supplies group.
- 1% drop in the non-ferrous metal products group.
- 10% gain in the miscellaneous group boosted by a 15% increase in professional and scientific equipment.

Further detailed information is available on request to the Editor of Design Engineering.

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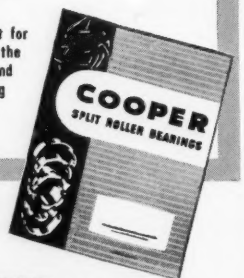


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## Inventor of combine retires as designer

The creator of the self-propelled grain harvesting combine, Tom Caroll, has retired at the age of 73.

He was chief engineer of the world-wide farm machinery network of Massey-Ferguson Ltd., based in Toronto. He

had been with the company as product designer for 50 years.

Born in Australia, Mr. Carroll designed his first self-propelled combine for the then Massey-Harris Company in 1937. His principle of self-propulsion for farm machinery led to its adoption for other types of agricultural equipment.

## Canadian steel firm gets India contract

Know-how for producing special quality steel will be provided to a new steel mill in India under a contract with Atlas Steels Ltd, Welland, Ont.

The new mill is to be built at Dur-

# People . . . . . and events

*(Continued)*

gapur, about 100 miles from Calcutta, by India's Hindustan Steel Ltd.

Atlas won the contract in competition with steel producers from all over the world.

In addition to supplying know-how Atlas will set up training programs in Canada for groups totaling 100 technicians.

### Canada's first seminar on power engineering

A three-day power engineering seminar, the first in Canada, is expected to draw 6,000 engineers to Canada's Power Show, December 7 through 9.

It will be held in a special theatre-auditorium being built in Toronto's Queen Elizabeth Building, adjoining the Show in Exhibition Park.

Papers will be presented on the latest engineering techniques in design and maintenance. Speakers will answer the question: What fuel does what job best? They will discuss hydro-electric, nuclear and thermal energy.

### Canada steps up trade fair program

An estimated 18,642,000 people will be told about Canadian products at trade fairs around the world during the next eighteen months.

The estimate was made by the Department of Trade and Commerce which has launched a drive to more than double Canada's participation in trade fairs in 1962 alone. Canadian products will be displayed at 34 trade fairs next year compared with 16 this year.

In addition 21 fairs are already slated for the first half of 1963.

The Department bears most of the cost of exhibiting, designs and builds the exhibits, and plans and executes coordinated advertising and publicity campaigns. However participating firms must supply a staff member to man the booth.

The Department has published a booklet on its plans for 1962, copies of which are available from the Department.

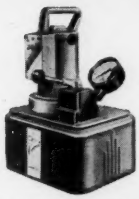
### Quebec presents brief on technical training

The Corporation of Professional Engineers of Quebec has recommended important changes in the technical and professional training system in their province.

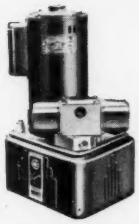
The recommendations were contained in a brief presented to the Provincial

*(Continued on page 60)*


# New, unique 2-stage hi-pressure hydraulic pumping units-dual volume and pressure

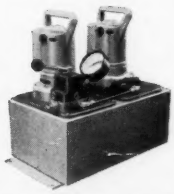


With 1⅛ H.P. universal motor, 4-way manual control valve, gauge and 2-gal. reservoir. Wt. 45 lbs.

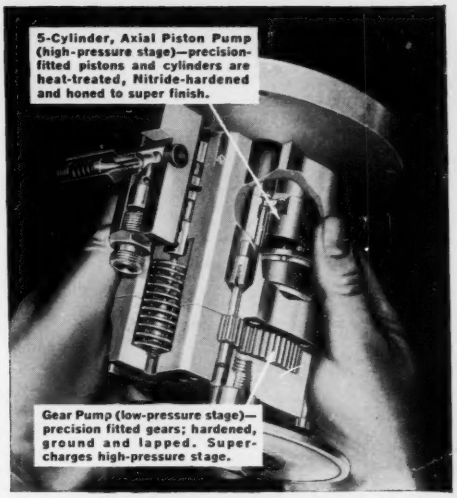


With 3450 r.p.m. 1½ H.P. jet pump motor, 4-way solenoid valve and 2-gal. reservoir.

With 3 H.P. gasoline engine, 4-way manual control valve, gauge and 5-gal. reservoir.



"Tandem" hookup—two Vanguards in a single 7 gal. reservoir with single 4-way valve; produces twice the volume.


5-Cylinder, Axial Piston Pump (high-pressure stage)—precision-fitted pistons and cylinders are heat-treated, Nitride-hardened and honed to super finish.
Gear Pump (low-pressure stage)—precision fitted gears; hardened, ground and lapped. Supercharges high-pressure stage.

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New OTC "Vanguard" complete power packages are versatile, precision-built units that handle high pressure, high force requirements, yet provide fast ram approach and return . . . no wasted time in getting the cylinder piston to and from the work!

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| 400 cu. in./min. @. . . 500 psi | 400 cu. in./min. @. . 500 psi |
| 130 cu. in./min. @. . .1000 psi | 80 cu. in./min. @. . 1000 psi |
| 90 cu. in./min. @. . .6000 psi | 50 cu. in./min. @ 10,000 psi |

A wide variety of accessories are available to utilize the "Vanguard's" exceptional performance: choice of motors; gasoline engine; 2 and 4-way lever control valves; 2 and 4-way solenoid valves; pressure switch; pressure regulating valve; manifold; reservoirs; gauges.

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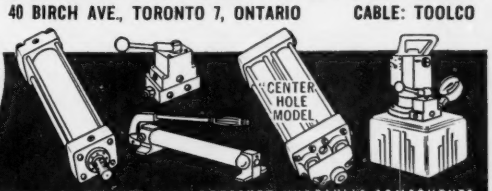


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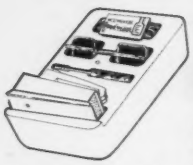

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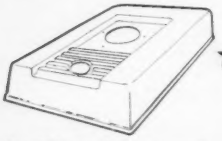

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# People . . . . . and events

*(Continued)*

Committee on Technical and Professional Training. It notes several deficiencies in the Quebec system of specialized studies, which "it seems, has not progressed at the same rate as the industrial technology." It points out that Canadian industries frequently have to call on overseas specialists to fill technical positions.

Some important recommendations are:

- Establishment of technical institutes of superior levels to train graduates who would act as intermediates between engineer and other classes of workers.
- Accreditation of curricula of technical institutes.
- Certification of technicians.
- Extra-mural education by encouraging employees to enroll for evening or correspondence courses.
- Liaison between institutes and engineers' groups, industry and universities.

## Men on the move

Donald J. McChesney promoted director of plant engineering, Ford Motor Company of Canada Ltd., Oakville, Ont. George A. Atkins becomes assistant general manager (production) and Glenn B. Ruiter assistant general manager (planning) at Ford.

*Goodings*

*Harold*

William R. McLellan joins Precision Instrument Company, Ottawa, as senior systems engineer.

R. C. Beal appointed manager of engineering, British American Oil Company Ltd., Toronto. R. D. Meagher becomes co-ordinator of mechanical engineering and S. K. McWalter co-ordinator of process engineering.

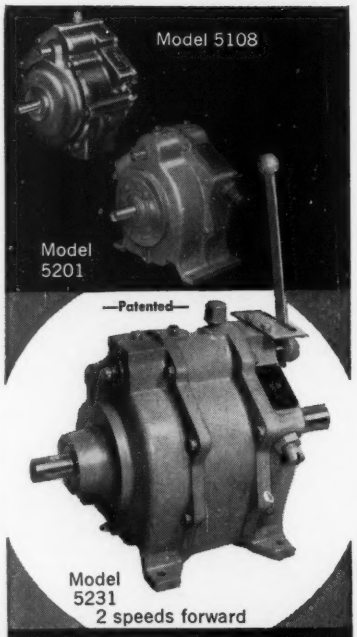
Blake H. Goodings, P.Eng., appointed director of the new employment and counselling service of the Association of Professional Engineers of Ontario. J. O. Harold, P.Eng., is a new field representative.

Leo Roth appointed general manager Dayton Rubber Company (Canada) Ltd., Toronto.

Dr. S. Roy Morrison, formerly of Saskatoon, appointed senior staff scientist at Minneapolis-Honeywell research centre, Hopkins, Minn.


# S-N REVERSING TRANSMISSIONS

*5 models 8 and 28 h.p. with power packed versatility*

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**SPECIFICATIONS**

| Model No. | | 5231 | 5201 | 5108 |
|---|---|---|---|---|
| Reduction Forward | | 1.97:1 3.34:1 | 3.16:1 | 3.75:1 |
| Ratio Reverse | | 3.37:1 | 3.16:1 | 3.75:1 |
| Power Up To | | 28 HP | 28 HP | 8 HP |
| Max. Input Torque in. lbs. | | 1000 | 1000 | 320 |
| Max. Input Speed RPM | | 2400 | 2400 | 2400 |
| Dimensions | Long | 15 11/16" | 11½" | 9 1/16" |
| | Wide | 14" | 13½" | 10" |
| | High | 14¾" | 14¼" | 10⅜" |

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Industrial Division
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For Over Half a Century

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## Letters to the Editor

*continued from page 3*

Some reasons for this opinion are that there have always been in existence movements to improve and cheapen the methods of obtaining patent and design protection, and these movements have been accelerated greatly in recent years by the new groupings of nations into trading blocks (e.g. by proposals for a single patent for all countries in the block). In all of the industrial nations the changes in technology, and the fight for export markets, has led to an upsurge of interest in design legislation that will provide strong and rapid protection. In addition, the new nations are beginning to establish industries and simultaneously to enact strong patent and design protection laws.

All of these trends mean that the foreign designer will in the future be able to obtain good protection in all the important markets for a very reasonable outlay, and will find it correspondingly easier to freeze out the pirates.

**Argument against**

The proponents of "no legislation" may answer the above argument by the counter that our designers can still produce original designs and protect them abroad to secure our export trade.

I believe anyone with the necessary experience of secondary manufacturing knows that home and export markets cannot be separated in this simple manner, and that the lack of a firm home market usually means no export capability at all.

Moreover, you have often in this publication emphasized the vital need in Canada for a body of original and progressive designers. The adequate protection of their work for the home market is an important factor in the struggle to produce and keep such designers in Canada.

The exchanges of international trade ultimately involve ordinary human beings with feelings and opinions, and I am sure our fight for export markets can only be hindered if our "national picture" becomes that of a people who operate by making cheap (and probably nasty) copies of our more progressive neighbours products.

Many of us still find we have an instinctive bad reaction to any Japanese goods, inherited from pre-war days, even to those goods of superior technical excellence and design. The fact that the Japanese recognize the longer term evils of a piracy policy is evidenced by a report in the Montreal Gazette for May

*(Continued on page 62)*


ROPER PUMPS

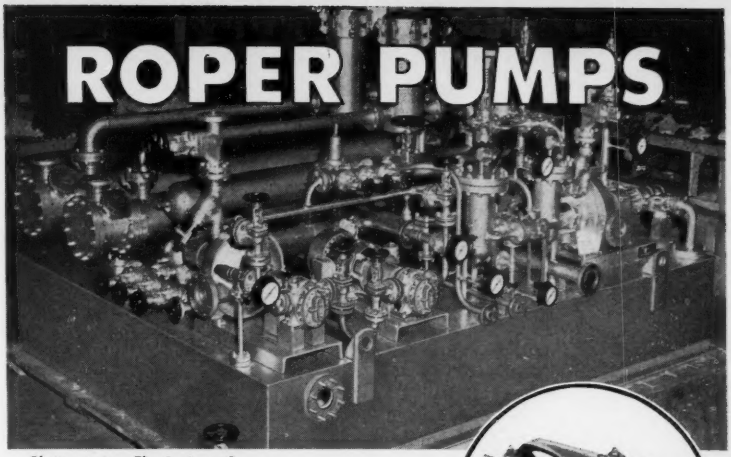
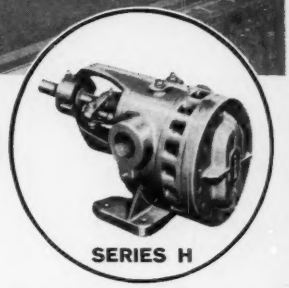


*Photo courtesy The Engineer Co.*

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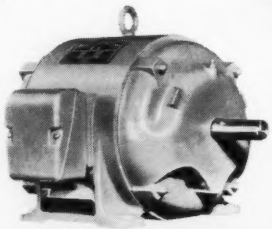

*Since 1904*

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**15 Belfield Road, REXDALE, Ontario**

Representatives in: Saint John, N.B.; Quebec; Montreal; Toronto; Guelph; North Bay; Winnipeg; Regina; Calgary; Edmonton; Vancouver.

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## Letters to the Editor

*Continued*

20, 1959, that the Japanese Government had passed a law to stop the copying of foreign designs by Japanese exporters.

**May meet reluctance**

Mr. Johnson's proposed method of meeting this emergency by use of the Trade Mark Act is ingenious, but all trade mark practitioners will be reluctant to see our well designed and highly successful trade mark act distorted to accommodate industrial designs.

This question of adequate design legislation was the subject last October of a paper at the annual meeting of the Canadian Patent and Trade Mark Institute. It seemed apparent to me from the meeting that the inclination of the experts in the field is towards the copyright form of protection, but for a shorter period than is at present granted for works of art. The meeting also seemed to me to show that the thinking which produced our Royal Commission report is already out of date.

For example, the legislation proposed is based on the British Industrial Designs Act, but Britain is already contemplating changing to the copyright form of protection.

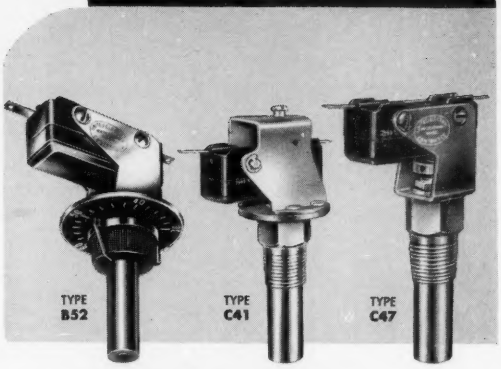
Good legislation, like good wine, requires a relatively long period to develop and mature, and a satisfactory solution to this problem is long overdue. I hope that the response to Mr. Johnson's article will be such that both you and Mr. Johnson will be encouraged to continue the good work.


**S. J. Rogers,**
**Patent and Trade Mark Agent,**
**Patent Department,**
**Canadian Westinghouse Co. Ltd.**
Burlington, Ont.

*" . . . then, after selling wimskets to the textile trade, I've had eighteen months as purchasing agent for the five-and-ten, eleven months as an observer on . . . "*

# SPACE OR WEIGHT LIMITATIONS?

B52 | C41 | C47




## Specify Local Mounted
## UE SKELETON TYPE
## TEMPERATURE CONTROLS

**UNITED ELECTRIC** temperature controls are precision-built, compact and economical. Type B-52 was designed especially for controlling air temperatures . . . Type C41 and C47 for liquid or hot plate temperatures . . . These controls are direct-immersion units designed for easy installation.

| | |
|---|---|
| **Temperature Ranges** | Type C41 & C47 100° or 200° between 0° and 425° F limits. Type B52 calibrated 40° F spans between 30° and 120° F. |
| **Thermal Assemblies** | various immersion lengths . . . liquid-filled seamless brass bellows operate by hydraulic action |
| **Switch Ratings** | 15 amps or 20 amps at 115 or 230 volts A.C.; also D.C. switches available upon specification |
| **Switch Actions** | N.O., N.C., or Double Throw, no neutral position |
| **Electrical Connection** | attached directly to screw or solder terminals on switch |
| **Size & Weight** | approx. weight . . . 4½ oz., approx. size . . . 3⅞" x 2" x 1¼" |
| **Variations** | design variations available upon specification |

**UNITED ELECTRIC** *manufactures a complete line of temperature, pressure and vacuum controls. For applications requiring custom-built units or modified standard units, call upon a UE application engineer for recommendations. Write for complete specification and pricing data on the Type B52, Type C41 or Type C47 local mounted temperature control, and for information regarding other United Electric temperature controls.*

# UNITED ELECTRIC

CONTROLS (CANADA) LTD.
35 O'Connell Ave.
Dorval, Quebec, Canada

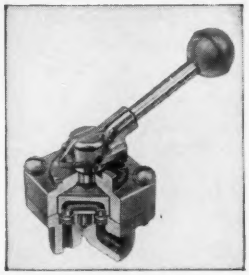
For further information mark No. 145 on Readers' Service Card



# DESIGN NOTES ON FLUID POWER

## RELEASE NO. 13: HOW TO SELECT AN AIR VALVE

When you are buying a manual 4-way valve to operate an air cylinder or an air motor, here are some of the characteristics you should be looking for:



1 It should be easy to mount, whether on a table, a wall, a column, on the piping, or in a panel.

2 It should never leak, even after months and years of service. The hiss of leaking air in your plant is like the clink of money going down the drain.

3 Maintenance should be easy and simple. It should be possible to dismantle the valve without removing the plumbing.

4 It should have large flow passages, so that it will not restrict the flow of air; on the other hand it should be so designed that it can be used for throttling, in order to offer speed control.

5 Its price should be low enough to make the purchasing agent smile.

6 Its appearance should be smart and handsome to match your desire for an appearance of modernity.

**We know you saw it coming, but we simply have to add that the Barksdale 5000 series manual 4-way valves meet ALL the above requirements. Their patented "Shear-Seal" design truly means NO LEAKAGE. The 5000 series, illustrated, is rated for 250 psi air.**

***ROUSSEAU CONTROLS LTD.***

640 De Courcelle St., Montreal 30, P.Q. WE. 7-3521
2149 Yonge St., Toronto 7, Ont. HU. 3-2766

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# Briefs

**Rocket rattling:** Many things can prevent a rocket from firing. But the cause of a recent failure in California was something new. When the igniter did not light the scientists' diagnosis was foreign matter. The plant's mongrel mascot had mistaken the igniter for a fire hydrant.

**Real speed:** A new motor which turns over 5,000 times in the flick of an eyelid is being manufactured in the U. S. It has air bearings, runs indefinitely without oiling, and has possible use in everything from missiles to household refrigerators.

**Shaw Process:** Automated machinery for the new Shaw Process (precision casting with ceramic molds will soon be available in North America. An agreement has just been signed between a U. S. company and the British developer.

**Computer availability:** A technical information service has been instituted to publish standardized commercial availability of computers and programming systems. Subscribers will receive detailed comparison charts and other information to help decide the most suitable unit.

**Computer glossary:** Two international organizations are to join forces to produce a multilingual glossary of automatic data processing terminology. It should be available by August 1962.

**Oil-free motor:** From Britain comes a geared motor unit which needs no lubrication. It should be ideal for food and clothing processors where oil might contaminate the product.

**Better iron:** Low-frequency induction furnaces developed in Italy are now available in North America for the metal-melting industry. It's claimed the furnace design sets up a controlled stirring action that produces a fine-grained, well-homogenized metal with improved mechanical properties.

**Name upheld:** Polarad Electronics Corporation's right to continued use of its corporate trade name has been upheld by the U. S. Supreme Court. Petition for a writ of certiorari had been filed by Polaroid Corporation following earlier judgments in lower courts.

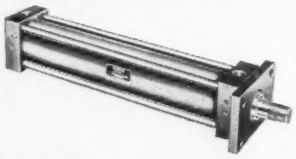
**Automatic camera:** Another automatic camera is on the market (see DE Reports, July, 1961). This time it uses 2 penlight batteries to power a small motor which rewinds the film. A previous camera used capsules of carbon-dioxide.

**Industrial drier:** Canadian Westinghouse is using a low boiling petroleum solvent vapor under controlled vacuum system to dry high-voltage electrical equipment. It is useful in reaching water-saturated cellulose insulation when arranged in an inaccessible form.

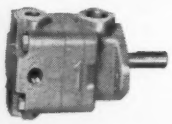
**Geographical engineering:** This is a new study predicted by Dr. G. Brooks, incoming president of the American Society of Civil Engineers. For example, he cites a plan to excavate an entire harbor in Alaska using nuclear explosions. The geographical engineer would calculate the economics of such projects. ★


**EVERYTHING HYDRAULIC**
**from components to complete systems**

Whether your installation calls for a single pump and cylinder or a complete electro-hydraulic system, you enjoy convenience and technological benefits, too, when the choice is Vickers-Sperry. Fully qualified engineers are available to assist you in solving your problems from initial design to installation and start-up of the system in your plant. Here are highlights of the Vickers-Sperry line:

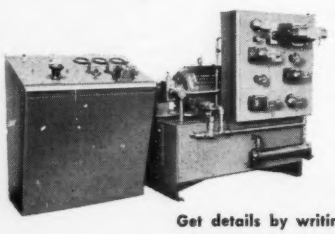


**HYDRAULIC CYLINDERS**–Standard bore sizes range from 1½" to 8", wide choice of mounting options available as well as special designs if needed.



**PUMPS**–Select from more than 500 standard models—vane or piston type, fixed or variable displacement—for oil or fire resistant fluids.

**DIRECTIONAL VALVES**–Solenoid operated, solenoid-controlled-pilot-operated and miniature valves cover entire application range. Models available for flows to 300 gpm, pressures to 3000 psi.



**POWER PACKAGES**–Both standard and custom engineered power packages are available from Vickers-Sperry. Standard components are selected from complete Vickers line to hold down costs. Rigid inspection and test before shipment minimizes start-up problems.

**Get details by writing for Catalogue 5001C.**

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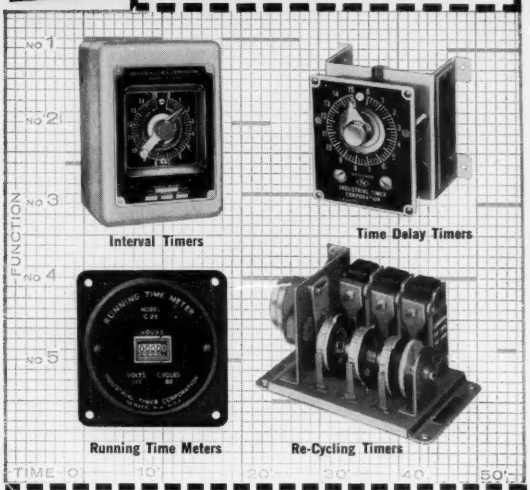
## AUTOMATIC TIMERS

A complete line for industrial applications and original equipment

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The Most Compact Solenoid Valve in the Fluid Power Control Field...

# VERSA SERIES "A"

Versa's new four-way solenoid valves measure only 5½" high by 1⅝" diameter, yet have a full 3/16" diameter flow area. Completely corrosion-resistant and simple to install, Versa Series "A" solenoid valves are available in over 100 different variations. Triple pressure and functionally tested under water for guaranteed leakproofness.

**VERSA**

VERSA PRODUCTS COMPANY INC.
150c COOLIDGE AVENUE
ENGLEWOOD, NEW JERSEY

Write today for your free copy of Bulletin #1259

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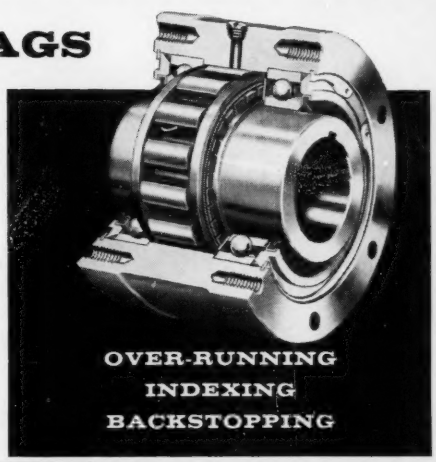
# NEW HIGHER PERFORMANCE FORMSPRAG OVER-RUNNING CLUTCHES

## WITH FORMCHROME* SPRAGS

Greatest torque capacity for clutch size and weight, no measurable backlash, extreme precision and long trouble-free life have always been provided by Formsprag clutches. Now! The best over-running clutches provide even higher performance. For, they have Formchrome sprags that are corrosion resistant, and have high hardness and abrasion resistance similar to tungsten carbides. Result, sprag geometry is retained longer and clutches can be used on higher over-running-speeds. For further information, send for technical paper "Formchrome Sprags" or for Formsprag Catalog.

*Formchrome sprags are produced under a patented process. The use of this process in the manufacture of over-running clutches is exclusive with Formsprag.



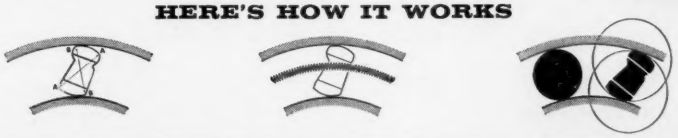

**RENOLD CHAINS** CANADA LIMITED

HEAD OFFICE: 1006 MOUNTAIN ST., MONTREAL
MANUFACTURING FACILITIES, BRANTFORD, ONTARIO

RENOLD *Branches across Canada*

CALL **RENOLD**... FIRST NAME IN POWER TRANSMISSION

### HERE'S HOW IT WORKS



Formsprag clutches have a full complement of sprags between concentric inner and outer races. Dimension AA is greater than BB. Rotation of one race in "driving" direction causes the sprags to wedge, transmitting full torque from one race to the other.

An energizing spring keeps the sprags in light contact with both races . . . there is thus no lost motion. When force is applied to the driving member, the driving torque is instantaneously transmitted between races, slippage or backlash is eliminated.

The sprag is, in effect, a "roller" of larger diameter having greater contact surface, and more sprags can be inserted within a given diameter for greater torque capacity. Also, sprags engage at constantly changing contact points to prolong clutch life.

### HIGHER PERFORMANCE ON TYPICAL APPLICATION

A Formsprag clutch with Formchrome sprags was installed in the reaction member of a torque converter and a competitive clutch in another. After the equivalent of one year of operation, the competitive clutch showed excessive wear. The Formsprag clutch run 50% longer and showed only negligible wear. There is a Formsprag clutch for your every need—send for free catalog.

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DEPENDABLE LEAK-PROOF SEALING
under all PRESSURES and TEMPERATURES

# PRECISION "O" RINGS and DYNA-SEALS are FIRST in QUALITY!

Whatever the sealing problem Precision can help! Simple construction fits "O" Rings into limited space. They make dependable, dynamic and static seals, at low cost, through wide ranges of pressure and temperature.

Dyna-seals - synthetic rubber bonded to steel - are the answer to flange sealing problems.

Contact our Sales Engineers or send for the NEW Engineering Handbook

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*"O" Ring and Dyna-seal Specialists*

Toronto, Ontario - Ste. Thérèse, Québec

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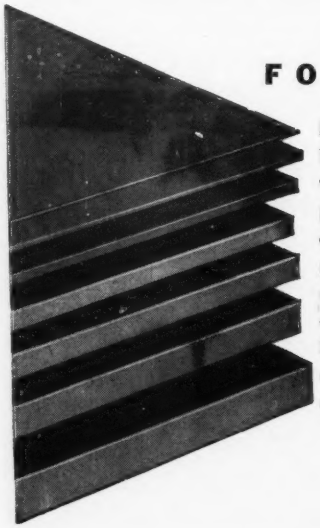
very material to your needs

# Formapex

*Synthetic Resin Bonded*

LAMINATES

For silent gears and pinions, bushes, washers, bearings and small mechanical parts . . . for jigs . . . for electrical control panels, terminal boards, etc. Formapex has special advantages — high strength/weight ratio, high dielectric strength, low coefficient of friction, resistance to heat, moisture, chemicals, etc.



**FORMAPEX**

Formapex is supplied in sheet form, in various fabric and paper base grades. It can be machined and punched, and there are grades to meet all appropriate British Standard, N.E.M.A. and D.I.N. specifications.

**IOCO LIMITED**

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TELEPHONE: SCOTSTOUN 5501.

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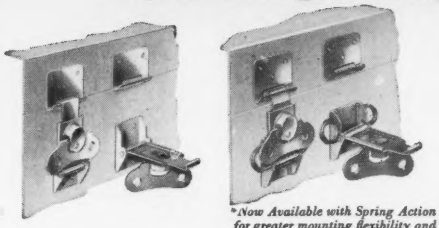
## Look to LINK-LOCK* for pressure-tight sealing



*Now Available with Spring Action for greater mounting flexibility and automatic take-up... where desired.

Here's a positive-locking fastener you can use wherever preloaded closure is desired. Heavy pull-down pressure insures water-tight sealing when gaskets are used. Offered in three sizes, LINK-LOCK is compact, simple in design, economical. Open or closed, it always lies flat. Provides excellent impact and drop-test resistance, is trouble-free even at −70° F. A natural for instrument cases, storage boxes, etc. Write for samples and 40-page catalog.

**SIMMONS FASTENERS**

Quick-Lock · Spring-Lock · Roto-Lock · Link-Lock · Dual-Lock · Hinge-Lock

SIMMONS FASTENER CORPORATION
1776 North Broadway, Albany 1, N. Y.

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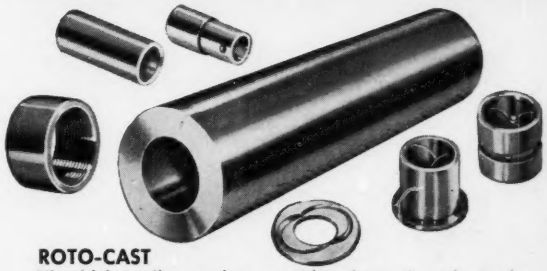
## FOR QUALITY AND ECONOMY IN PRODUCTION ROTO-CAST

### Central Bronze Bars or Precision Finished Bronze Bushings



**ROTO-CAST**
The high-quality castings resulting from the advanced ROTO-CAST process offers Industry a bronze bar as perfect as metal can be—no hard spots, no sand or gas inclusion, no shrinkage cracks—dense, fine-grain structure throughout. Cut scrap loss 15% to 50%—40% to 60% longer wear.

*Write for our stock and weight list.*

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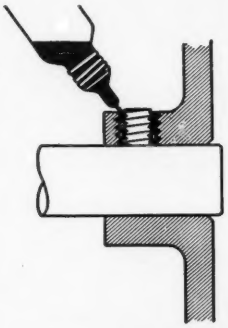

## One drop of Loctite and a set screw stays put!

Loctite Sealant, "the Liquid Lock Washer," wicks between threaded surfaces . . . then hardens in the joint. Locking action extends over entire engaged area. Result: an end to costly breakdowns caused by vibration-loosened screws. Parts treated with Loctite are removed easily with ordinary tools.

*For information and free sample write*
*J. S. Parks & Co., Ltd.,*
*220 St. Paul W., Montreal, Canada.*

**LOCTITE®** SEALANT
AMERICAN SEALANTS COMPANY

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## Shaft Seals That Cut Original Equipment Costs

Every problem of the manufacturer has been considered... from production line requirements to the cost of components in end product pricing.

**THESE ARE SOME OF THE ADVANTAGES OF JOHN CRANE PRODUCTION SHAFT SEALS:**

**Economy**—Low unit cost is achieved through mass production.

**Fast, Easy Installation**—Unit construction permits them to be quickly pressed into position.

**Minimum Stock**—Four sizes, ⅜", ½", ⅝" and ¾" can be used for all intermediate shaft diameters to ¾".

**All Service Conditions**—Only three types are needed for all services . . . water to destructive acids, temperatures from −100° to +500°F . . . pressures to 150 psi.

Tell us about your requirements. We will give recommendations or provide assistance. For general information ask for Bulletin S-216 and S-205-3.

Crane Packing Company, Ltd. Box 134, Station C, Dept. SSA, Hamilton, Ont.

John Crane CRANE PACKING COMPANY, LTD.
OFFICES IN PRINCIPAL CANADIAN CITIES

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# backlash

## Maple leaf forever?

While we're not particularly anxious to face the barrage of criticism that is sure to follow this article, DE still thinks the subject vital enough to throw it into the ring. It concerns the traditional maple leaf, for decades the symbol which is immediately identified throughout the world as Canadian.

In the past few weeks we've had news that one company has decided to incorporate it in its trademark, while another has given it the cold shoulder. An announcement that the E. W. Bliss Company would use the maple leaf to distinguish its products of Canadian origin followed closely on the heels of Canadian National Railways' decision to scrap its messy maple leaf logo. Both had good reasons. Bliss wanted to assure people of the origin of its machinery manufactured in Canada by its Canadian subsidiary. CNR wanted a more streamlined symbol, and anyhow did not have to convince too many that it was Canadian.

CNR's reason makes us think. The involved maple leaf pattern does not lend itself to simple functional image design. It conveys the impression of things Canadian because of its long association with the Canadian scene. Bus most vigorous Canadian companies want to indicate their modern attitude with straight-line symbols.

The only thing, then, is for someone to come up with a modernistic maple leaf without breeding a new variety of maple tree. We're looking for suggestions.

## Industry snubs war threat

Apparently a big majority of North American industry has not yet seen any significant cause for alarm in recent threats of nuclear war.

In a survey of 205 US manufacturing firms only five per cent had built fallout shelters for their staff. Less than five per cent still had no plans for building.

However many companies have made provisions for safeguarding vital records in the event of disaster, though not necessarily nuclear. And many have specific arrangements to assure continuity of management in an emergency.

Of those firms which have prepared for staff protection, most have gone the whole way. Some have provided for alternate headquarters, set up rescue teams and organized squads for detecting and measuring fallout.

This proves there are some who feel confident industry can partly survive a nuclear war.

## Giving away degrees

Just how important is a university degree?

To the graduate, who has waded through piles of textbooks, sat up late at night, endured mental torture and written theses and essays, it means a lot.

To the employer it is a good indication of a man's understanding in certain subjects.

So it still has an importance which cannot be lightly brushed aside.

Yet today we have hundreds of citizens who can, technically speaking, write a group of letters after their name although they have not run the study gauntlet, Canada's Prime Minister can boast a string of honorary degrees and so can many, many other people prominent in public life. But it's getting to the stage where almost anybody will be able to claim an honorary degree for services to a university, industry or profession.

One of the most interesting examples is a Detroit advertising agency principal who was recently awarded an honorary degree in mechanical engineering by Stevens Institute of Technology. He won it for "accomplishments in the general field of engineering". Admittedly he was an editor on several leading technical and business publications, a public relations man for industry and a member of several technical societies.

But while DE, naturally, recognizes the contributions the field of communications can make to industry, it still does not feel degrees should be given away so freely. Perhaps some other form of recognition is needed for such circumstances.

## We're waging war

For some months now we have been waging a private war with those US companies that send us press release items . . . but fail to take any notice of the fact that the release is going outside their own country. Our biggest complaint is with companies that have Canadian associates or agents, but they never get mentioned in the releases . . . even the ones coming into Canada. Our procedure has been to send a little postcard pointing out that we have the material in hand, but before we will publish it we must know how the company proposes to serve its potential Canadian customers.

Well, the war is beginning to pay off. Some US companies have even taken the trouble to write us a little note thanking us for bringing the omission to their attention. And, some others have set up a routine procedure to ensure that the necessary information is included with the original mailing. The item below originated with a Detroit advertising agency . . . and is an example of the effect our campaign is having.

Cable Address "MICRO DETROIT"

MICROMATIC HONE CORPORATION

Manufacturers of MICROHONING MACHINE TOOLS

8100 SCHOOLCRAFT AVENUE
DETROIT 38, MICHIGAN U.S.A.

NOTE TO EDITOR:

For your information and convenience, here is the name and address of Micromatic Hone Corporation's Canadian subsidiary, should you wish to include it when using this editorial material:

MICROMATIC HONE, LTD.
330 Grand River Ave.
Brantford, Ontario

# FOR SPRINGS CHECK WITH HWP first

The latest facilities and techniques are combined to assure you of quality-built springs and wire forms at low ultimate cost. Send samples, drawings or specifications for quotation.

HWP SPRINGS

Compression • Extension • Torsion

Hamilton Wire Products Company Limited
Hamilton, Ontario
Hamilton LI. 9-3525 • Toronto EM. 6-6119

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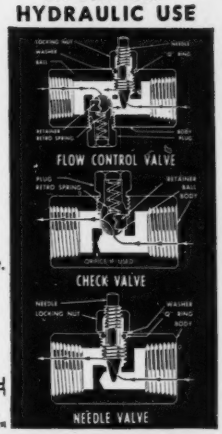
# Get Easier, More Accurate Cylinder Speed Control

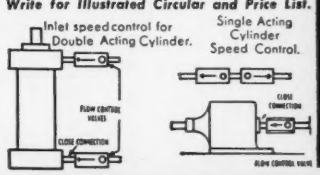
2,000 (brass or aluminum) and 5,000 (steel) p.s.i.

with **Pneu-Trol** VALVES IN AIR OR HYDRAULIC USE

Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Check Valve and Needle Valve incorporate single function features of Flow Control Valve. All valves available in 5 female pipe sizes — 1/8" to 3/4". Valve bodies are made from brass, aluminum, steel or stainless steel. Attractive Prices — Immediate Delivery.

***Write for Illustrated Circular and Price List.***




AUTOMATION AUTO-PONENTS INC. COMPONENTS

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BELLWOOD (Chicago Suburb) ILLINOIS

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# JUNIOR AIRHYDROPUMP

## HAS MANY USES

- Maintains pre-set pressure indefinitely.
- Operator has both hands free—pressure is automatically raised.
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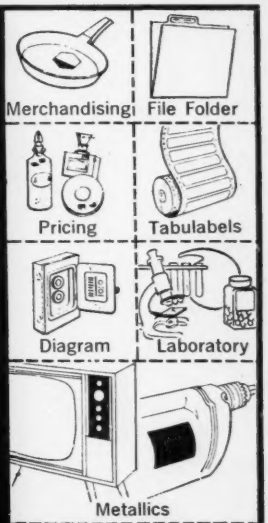


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# Editorial

## The marks of a good designer are many

. . . is reducing waste one for which you are known?

It has been said that reducing waste is just as important as increasing income. Whether we speak of industry, one's personal life, or the business of our country, true economy consists in seeing that we always get our money's worth.

But what has this to do with design engineers? Are not the managers, department heads, supervisors and foremen directly responsible for controlling waste in our modern industries? Yes, they are . . . but in some ways we look upon the design engineer as having a little something extra in the matter of responsibility for waste.

Let's take a close, critical look at the situation. While observing the erection of part of a new industrial plant some weeks ago we noted that the ductwork for the air conditioning appeared very impressive . . . impressive in size, that it. Since we understood that there were no special production requirements for an extra amount of air, we did a little snooping. A few discreet enquiries revealed the truth of the situation — the ductwork was oversize; in fact the whole air-conditioning facility was very much oversize.

It seems that away back when the system was being designed, the engineer on the job slipped a little in one of his calculations and a factor of 10 crept into the works. By the time the error was discovered it was too late. The big trouble was that the waste was compounded . . . the oversize unit required more space, extra floor bracing had to be added, facilities for cooling water had to be enlarged, and the over-all cost was considerably above what it should have been. **Waste? Definitely!**

Or take the case of the little plastic moulding we examined the other day. We hesitate to identify it exactly, but we can say that its function involved relatively no strength requirements. Yet the thinnest portion of the moulding was as thick as our thumb. It seems that an engineer from the company supplying the resin had assisted in the design . . . he had obviously recommended the use of the greatest amount of material that he thought he could get away with. Of course — someone should have seen through this old sales gimmick immediately, but the moulder was the trusting type. **Waste again? Most definitely!**

Every design engineer has an opportunity to show the quality of his profession by designing products which avoid waste. How should he go about it? Well, we are afraid there is no one answer, because every condition calls for a different cure. But we can suggest some ways of attacking the culprit.

- Apply common sense in every design you work on. Backed up, of course, by sound technical know-how.
- Make efficient use of all materials. The most exotic or least expensive are not always the best. And remember that our country's supplies of some materials can never be replaced.
- Make certain of the design requirements. Do not overdesign. Don't use factors that up the costs, when those factors are not really called for.
- Keep up to date on the latest techniques . . . it's amazing how technology has advanced in the last ten years.

Little savings are worth looking for in everything we do. There is nothing small about being a waste-reducer. In fact, avoiding waste is one of the marks of the good design engineer.

Doug Kaill

# Wagner EXPLOSION PROOF

✓ SAFE
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✓ DEPENDABLE

This is an excellent motor. Within the solid 256U frame with its efficient ribbed cooling, you find Wagner's famous transverse greasing that ensures long bearing life. The "old" grease that might have picked up particles of grit is pushed out and cleansed with fresh grease. Only Wagner safeguards you this way. And the rotor is one piece—the fan blades form an integral part—and when it is balanced statically and dynamically, it stays that way for the life of the motor. To make it explosion proof, here is one of the things Wagner engineers do:

The conduit box is threaded on to a nipple and the nipple is welded into the frame. The leads come through the nipple into the box and the nipple is then sealed with a special epoxy compound. And, to top it all off, every single part is minutely inspected—100 percent inspected—on *each* and *every* motor.

The Wagner explosion proof motor is foolproof too!

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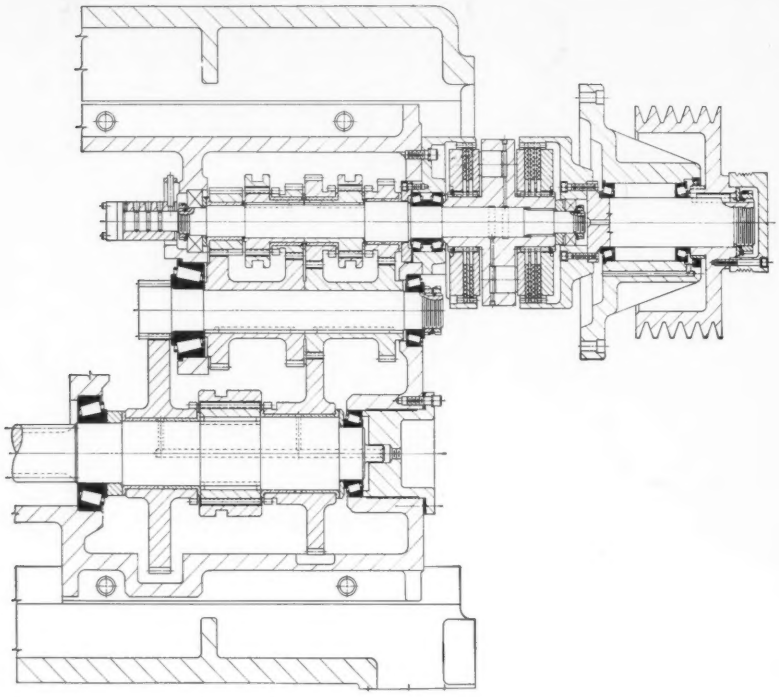
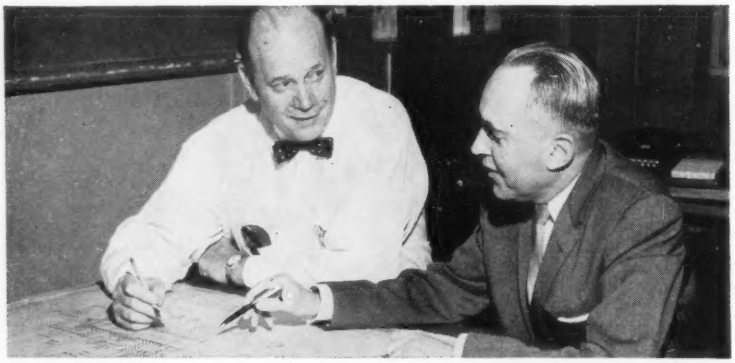
# Bullard fully powered vertical turret lathe uses Timken bearings to maximize production



When designing their Dynatrol® Vertical Turret Lathe, Bullard engineers' aim was to increase machine speed and output economically. Dynatrol provides single lever or remote control of all head motions, traverse and feed engagement. And Timken tapered roller bearings at vital points—table radial position, headstock, clutch shaft, input pulley, rail raising bracket—provide the load-carrying capacity under varying loads and speeds that assures maximum production. Their taper lets Timken bearings take *any* combination of radial and thrust loads. And precision manufacture of Timken bearings assures high precision in the machine.



**ENGINEERING SERVICE THAT SAVES YOU TIME AND MONEY.** Working with you at the design stage, our sales engineers can often solve your bearing problems on the spot. From the wide range of Timken bearing sizes, types and precisions they can help you select the Timken bearings to give you the maximum in efficient, economical design engineering.

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